

The Indiana Department of Transportation

Office of Geotechnical Engineering

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Driving Indiana's Economic Growth

January 11, 2006

Mr. Gerald Mroczka, Chief Design Division N642 - IGCN

Attn:

Ms. Tamera Stoakes

Project Coordinator

Subject:

Subsurface Investigation - Addendum 2

Des No: 8354420

Project No: STP-4320 (7)

SR 15 from 0.34 Mi. S. of US 20 to 1.92 Mi. N. of US 20

County: Elkhart District: Fort Wayne

Gentlemen:

The additional Geotechnical Investigation for the subject project has been completed and copies of the Geotechnical Report are being forwarded to those listed below.

If you have any questions concerning this matter, please call us.

Very truly yours,

For Athar A. Khan.

Chief Geotechnical Engineer

S. S. Horandy Somanath S. Hiremath

Geotechnical Engineering Group Leader

SSH/SS

Mr. T. Seeman - Attn: Mr. W. Smith - Attachment cc:

Mr. R. Alderman - Attn: Mr. J. Keefer - Attachment (2)

Mr. D. Cohen - Attachment

Ms. J. Somers - Attachment

Mr. J. Paauwe - Attachment

File

H:SSH/SS/8354420-2.doc

SUBSURFACE INVESTIGATION ADDENDUM 2

DES. NO.: 8354420
PROJECT NO.: STP-4320(7)
SR 15 FROM 0.34 MI. S. OF US 20 TO 1.92 MI. N. OF US 20
ELKHART COUNTY, INDIANA
CTL PROJECT NO.: 05050045IND

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION MATERIALS AND TESTS DIVISION 120 SOUTH SHORTRIDGE ROAD INDIANAPOLIS, INDIANA 46219

PREPARED BY:

CTL ENGINEERING OF INDIANA, INC. 6848 HILLSDALE COURT INDIANAPOLIS, INDIANA 46250

NOVEMBER 23, 2005



TL Engineering of Indiana, Inc.

48 Hillsdale Court, Indianapolis, Indiana 46250 none: 317/585-8277 • Fax: 317/585-8621

e-mail: ctlin@ctleng.com

AN EMPLOYEE OWNED COMPANY



onsulting Engineers ullet Testing ullet Inspection Services ullet Analytical Laboratories

Established 1927

November 23, 2005

Indiana Department of Transportation Materials and Tests Division 120 South Shortridge Road Indianapolis, Indiana 46219

Attention:

Mr. Athar Khan, P.E.

Chief Geotechnical Engineer

Reference:

Subsurface Investigation - Addendum 2

Des. No.: 8354420

Project No.: STP-4320(7)

SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20

Elkhart County, Indiana

CTL Project No.: 05050045IND

Dear Mr. Khan:

In accordance with your authorization to proceed, CTL Engineering, Inc. has completed the subsurface investigation on the above referenced site.

The report includes the results of our field and laboratory testing, and our analyses and recommendations for the foundations and earth related phases of the project.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

The Marshi

cc: Mr. Shahid Siddiqui, INDOT - Materials and Tests Division

Offices: Ohio, Indiana, North Carolina, West Virginia

SUMMARY OF SUBSURFACE INVESTIGATION

A subsurface investigation report for the roadway reconstruction on SR 15 and US 20 was prepared and submitted on August 15, 2001. Also, a subsurface investigation – Addendum 1 report was prepared and submitted on March 2, 2004 for the proposed sewer lines. This report is being submitted as an addendum 2. Under this addendum, the project involves the design and construction of one culvert on SR 15 and a culvert extension on US 20 as described below.

Location	Structure	Station	Line	Box Culvert Size	Boring	Flow Lin	e Elevation
Location	No.	No. Station Line Box Curven Size		No.	Up Stream	Down Stream	
SR 15	62	13+885	"B" & "C"	25m of 1194mm x 1804mm Pipe	TB-1 & TB-2	249.00	248.67
US 20	69	5+694	"S-US20-B"	6.0 m of 3910mm x 2235mm Multi Plate Box Culvert (Extension)	TB-3	N/A	N/A

A subsurface investigation for the subject sites has been completed and a summary of our findings and recommendations is reported below. Detailed foundation recommendations and construction considerations are provided in the subsurface investigation report.

FINDINGS

Test borings TB-1 and TB-2, drilled at Structure No. 62, encountered fill material to depths of 3.5 feet (1.07m) and 8.5 feet (2.59m). The fill is described as sand and gravel, sand, sandy loam and/or loam containing varying amounts of roots, organic matter and/or brick fragments. Below the fill, both test borings encountered sand deposits. Boring TB-3, drilled at Structure No. 69, encountered possible fill material over creek sediments to a depth of 8.5 feet (2.59m). Below, layers of clay loam, sand and silt were encountered throughout the drilled depth

Structure No. 62 on SR 15

The borings encountered very loose sand or on very stiff sandy loam fill at the culvert invert elevation. Groundwater is expected during excavation and placement of this culvert. It is recommended that all fill material and very loose sand be removed to a depth of 2 feet (600mm) and replaced with "B" Borrow material or No. 53 aggregate to provide a uniform subgrade below the culvert. A layer of geogrid Type 1 would be needed at the bottom of the excavation. The excavation should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Structure No. 69 on US 20

Very soft creek sediments containing organic matter was encountered at the proposed culvert extension invert elevation. Surface runoff and/or seepage water could be encountered. It is recommended that the soft creek sediments and/or soil containing organic matter be removed and replaced with "B" Borrow material or No. 53 aggregate. It is estimated that the excavation could extend to a depth of 2.5 feet (750mm) below the proposed invert elevation of the culvert. A layer of geogrid Type 1 would be needed at the bottom of the excavation. Removal of the undesirable soil deposits should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Wingwall footings may be designed using the soil parameters provided in the geotechnical report.

This summary is provided for general information only, and it should not be used as the only source for any design, estimating or bidding. Detailed recommendations are provided in the geotechnical report.



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Subsurface Investigation - Addendum 2

Des. No.: 8354420, Project No.: STP-4320 (7)

SR 15 in Elkhart County

CTL Project No.: 05050045IND

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I. PROJECT LOCATION AND DESCRIPTION

The project is identified as SR 15 from 0.34 miles south of US 20 to a point 1.92 miles north of US 20 in Elkhart County, Indiana. The project involves the design and construction of two culverts as described in Table 1.

Table 1 - Culverts

	Structure				Boring	Flow Line Elevation		
Location	No.	Station	Line	Box Culvert Size	No.	Up Stream	Down Stream 248.67	
SR 15	62	13+885	"B" & "C"	25m of 1194mm x 1804mm Pipe	TB-1 & TB-2	249.00	248.67	
US 20	69	5+694	"S-US20 - B"	6.0 m of 3910mm x 2235mm Multi Plate Box Culvert (Extension)	TB-3	N/A	N/A	

Note that a subsurface investigation report for the roadway reconstruction on SR 15 and US 20 was prepared and submitted on August 15, 2001. Also, a subsurface investigation – Addendum 1 report was prepared and submitted on March 2, 2004 for the proposed sewer lines. This report is being submitted as an addendum 2.

II. SUBSURFACE INVESTIGATION

Three (3) test borings, designated as TB-1, TB-2 and TB-3, were drilled near the proposed culverts to a depth of 20 feet (6.10m) each. TB-1 and TB-2 were drilled for Structure No. 62 and TB-3 was drilled for Structure 69. Locations of the test borings are shown on the Boring Location Plans in Appendix A.

The test borings were advanced with an All-Terrain Vehicle (ATV) drilling rig utilizing hollow stem augers (HSA) on October 25, 2005. Standard Penetration tests were conducted using a 140-pound automatic hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches.

Soil samples obtained from the drilling operation were preserved in glass jars and visually classified in the field and laboratory. Representative soil samples were tested for Natural Moisture Content, pH, Loss on Ignition, Atterberg Limits and Grain Size Distribution.



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Drilling, soil sampling and laboratory testing have been performed following INDOT, AASHTO and current ASTM procedures. Results from field and laboratory tests are shown in Appendix B and Appendix C.

Stations, offsets and surface elevations of the test borings were interpolated from the site plans and cross sections provided to us by INDOT.

III. <u>FINDINGS</u>

A. Soil Profile

Test boringsTB-1 and TB-3 encountered 10 to 12 inches of topsoil at the surface. Boring TB-2 encountered 5 inches of asphalt concrete over 4 inches of cement concrete.

Below the surface cover, TB-1 and TB-2 encountered fill material to depths of 3.5 feet (1.07m) and 8.5 feet (2.59m). The fill is described as sand and gravel, sand, sandy loam and/or loam containing varying amounts of roots, organic matter and/or brick fragments. Below the fill, both test borings encountered sand deposits. A layer of clay loam was encountered in TB-1 at a depth of 19 to 20 feet (5.79m to 6.10 m).

Below the surface cover in test boring TB-3, possible fill material was encountered to a depth of 4 feet (1.22m). Below, silty clay and sandy loam deposits were encountered to a depth of 8.5 feet (2.59m). These deposits are described as creek sediments, which contain traces to little organic matter. Below, layers of clay loam, sand and silt were encountered throughout the drilled depth of 20 feet (6.10m).

Detailed information of soil types, natural moisture content and standard penetration tests are shown on the enclosed test boring records in Appendix B and appended soil profile sheets in Appendix D and E.

B. Groundwater

Groundwater and/or seepage water was encountered in TB-1 and TB-2 at depths of 4.0 feet (1.22m) and 5.6 feet (1.70m), respectively. Groundwater was encountered in TB-3 at a depth of 13 feet (3.96m). Refer to the attached test boring records in Appendix B for detailed groundwater readings.



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IV. <u>DISCUSSION AND RECOMMENDATIONS</u>

Based upon the soil data obtained from field and laboratory testing, foundation recommendations for each culvert are provided in the following paragraphs.

A. Structure No. 62 on SR 15

The borings encountered very loose sand or on very stiff sandy loam fill at the culvert invert elevation. Groundwater is expected during excavation and placement of this culvert.

Based upon the above findings, it is recommended that all fill material and very loose sand be removed to a depth of 2 feet (600mm) and replaced with "B" Borrow material or No. 53 aggregate to provide a uniform subgrade below the culvert. A layer of geogrid Type 1 would most likely be needed at the bottom of the excavation. The excavation should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

B. Structure No. 69 on US 20

Very soft creek sediments containing organic matter were encountered at the invert elevation of the proposed culvert extension. Surface runoff and/or seepage water could be encountered depending upon the time of construction and amounts of precipitation.

Based upon the above findings, it is recommended that the soft creek sediments and/or soil containing organic matter be removed and replaced with "B" Borrow material or No. 53 aggregate. It is estimated that the excavation could extend to a depth of 2.5 feet (750mm) below the proposed invert elevation of the culvert. A layer of geogrid Type 1 would most likely be needed at the bottom of the excavation. Removal of the undesirable soil deposits should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Foundation and earthwork recommendations for both culverts are provided in the following paragraphs.



Subsurface Investigation – Addendum 2 Des. No.: 8354420, Project No.: STP-4320 (7)

SR 15 in Elkhart County

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- 1. The recommended allowable soil bearing pressures and the soil parameters required for the design of footings and wingwalls are provided in Table 2. These values apply to all design loads. Additional soil information may be found in the enclosed Test Boring Records in Appendix B and the soil profiles in Appendix D and E. Note that the allowable soil bearing pressures provided in Table 2 are based on the assumption that the wingwall footings will be placed at 4 feet (1.3m) below the proposed flowline.
- 2. Settlements of footings may vary at the culvert location due to variations in soil composition, void ratio and loading. It is estimated that total and differential settlements would be within tolerable limits.
- 3. The pH values obtained from the laboratory testing ranged from 8.4 to 8.7.
- 4. Temporary excavations in excess of 5.0 feet in depth should be sloped, braced and/or shored according to OSHA requirements. Excavation to bottom of the recommended footing depth and in fill areas may be accomplished using standard excavation equipment.
- 5. Prior to placement of footings, the recommended soil bearing pressure should be verified and approved by a qualified Engineering Technician under the supervision of a Geotechnical Engineer. Soft and/or loose soils not meeting the recommended soil pressure, should be removed, dried and recompacted or undercut and replaced with lean concrete, No. 53 aggregate, or as otherwise directed by the Engineer.
- 6. Groundwater and/or surface runoff is expected during construction at Structure 62. At this Structure, the sand deposits containing groundwater extend to Elevation 244.2±. Surface runoff and/or seepage water could be encountered at Structure 69 depending upon the time of construction and amounts of precipitation. Dewatering, if needed, may be accomplished using construction sump pump(s), or any dewatering system approved by the engineer.
- 7. Borrow type and placement, and drainage structure installations including footings should be in accordance with INDOT Standard Specifications and the culvert manufacturer recommendations.



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Table 2 - Soil Parameters for Wingwall Design

Soil Parameters	Estimate	d Values
Son Farameters	Structure 62	Structure 69
Allowable Soil Bearing Pressure, psf *	**	1000 ***
Angle of Internal Friction of Foundation Soil (φ), degrees	30	0
Friction Angle between Foundation Soil and Concrete (δ), degrees	20	0
Ultimate Cohesion of Foundation Soil (C), psf	0	600
Ultimate Adhesion between Footings and Foundation Soil (Ca), psf	0	400
Friction Angle of Backfill Material, degrees	30	30
Friction Angle between Wall and Backfill (δ _f), degrees	20	20
Unit Weight of Foundation Soil, pcf	115	110

^{*} Allowable soil bearing pressures are provided at a depth of 4 feet below the culvert invert elevations.

**	Width of Footings (feet)	Allowable Soil Bearing pressure (psf)
	2	700
	3	800
	4	900
	5	1000
	6	1100

*** Undrained shear method used. Recommended soil bearing pressure is estimated for the clay loam encountered between a depth of 2.69 m and 3.96m.

V. <u>CONCLUDING REMARKS</u>

A. Changed Conditions

Should plans for the proposed culverts be changed from those used in preparing this report, CTL Engineering of Indiana, Inc. (CTL) should be notified to make the necessary modifications to our recommendations to account for the changed conditions.



Subsurface Investigation - Addendum 2

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В. **Testing and Observation**

Experience shows that the subsurface soil conditions in an area sometimes vary from the ones indicated in the test borings at their specific locations. It is therefore recommended that an Engineering Technician, under the supervision of a qualified Professional Engineer be retained on the site to monitor the construction of spread footings and earthwork operations.

C. Closure

CTL has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analyses, conclusions, recommendations and other work product of CTL are instruments of service for this project only.

CTL assignment does not include, nor does this geotechnical report address the environmental aspects of this site.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

PROTESSIONAL MINISTERIOR Indiana Reg. No. 60900551

h' barshi

Paul L. Douglass, P.E.

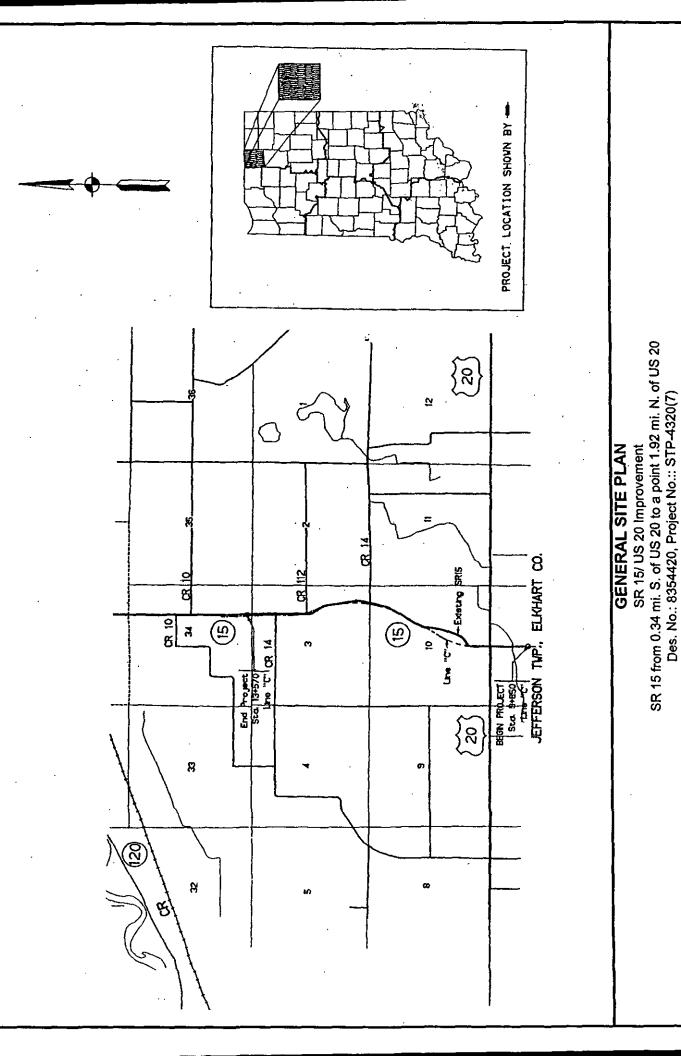
Principal Engineer

Indiana Reg. No. 60012388

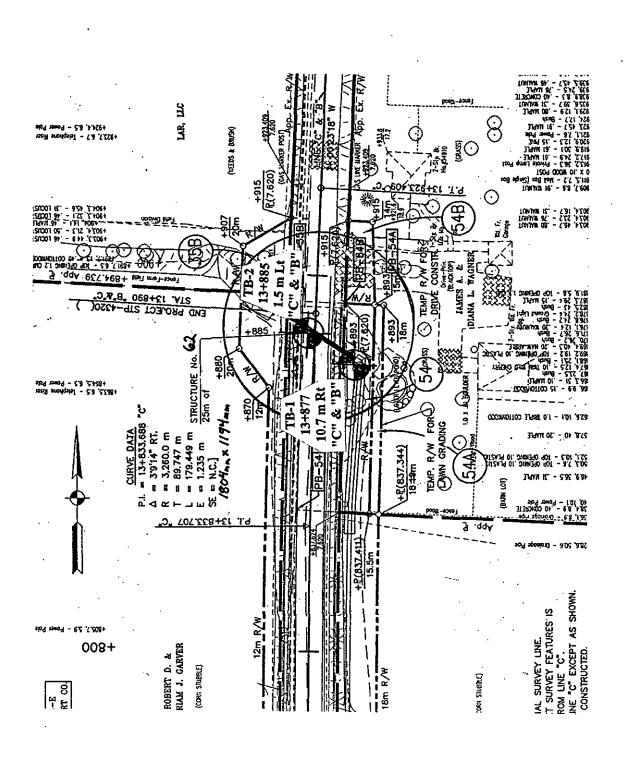


APPENDIX A

GENERAL SITE PLAN BORING LOCATION PLANS



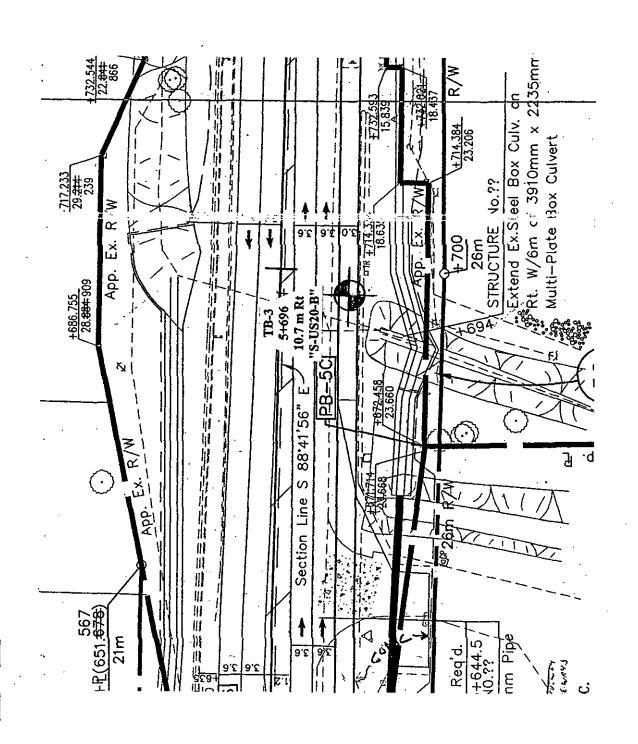
Elkhart County, Indiana



BORING LOCATION PLAN

SR 15 from 0.34 mi. S. of US 20 Improvement SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20 Des. No.: 8354420, Project No.: STP-4320(7)

Elkhart County, Indiana



BORING LOCATION PLAN

SR 15/ US 20 Improvement

SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20 Des. No.: 8354420, Project No.: STP-4320(7)

Elkhart County, Indiana

APPENDIX B
TEST BORING RECORDS

TEST BORING RECORD CLIENT : Indiana Department of Transportation BORING NO.: **TB-1** PROJECT : SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20 OF LOCATION : Elkhart County, Indiana DATE STARTED : 10-25-05 DES NO. 8354420; Project No.: STP-4320; CTL No.: 05050045!ND DATE COMPLETED: 10-25-05 BORING ELEVATION: 250.00 m (USC&GS) **BORING METHOD: HSA HAMMER** : Automatic **STATION** : <u>13+877</u> **RIG TYPE** CME-550 ATV DRILLER : ED **OFFSET** 10.7m Rt CASING DIA. : 83 mm I.D. TEMPERATURE: 50° F "C" & "B" LINE : Cloudy DEPTH 6.10 m **CORE SIZE** WEATHER Encountered at 1.22 m At Completion 1.22 m GROUNDWATER: 型 Caved in at <u>1.37 m</u> Unconfined Compression (kN/m²) Moisture Content (%) £ SPT / 15cm Atterberg Total Unit Weight (kg/m³) Stratum Elevation Recovery (%) Limits SOIL/MATERIAL DESCRIPTION SPT/ 30 Sample Depth Stratum Depth Sample Number Ē PL ΡI TOPSOIL (305mm) (Visual) 249.70 0.30 2 SS-1 5 23 Brownish Black, Moist, Soft, LOAM with 2 89 Traces of Roots and Organic Matter (FILL) 248.93 2 SS-2 2 4 89 2 3 **SS-3** 4 10 100 6 6 **SS-4** 14 89 3.0 Brown, Wet, Very Loose to Medium Dense, **SAND** with Traces of Gravel Visual) SS-5 12 100 5 244.21 5.79 Gray, Moist, Very Stiff, CLAY LOAM (TILL) **SS-6** 30 100 15 13 6.10 243.90 A-4 As Lab 2 17 Bottom of Boring at 6.10 meters Boring performed for Structure No. 62. Boring backfilled with soil cuttings. SAMPLING METHOD **ABBREVIATIONS BORING METHOD** - Hand Penetrometer HSA - Hollow Stem Auger - Split Spoon Sample SS SFA - Solid Flight Auger ST - Shelby Tube Sample LL - Liquid Limit - Rock Coring CR - Rock Core Sample PL - Plastic Limit РΙ MD - Mud Drilling BS - Bag Sample - Plasticity Index CTL Engineering of Indiana, Inc. WD - Wash Drilling SPT - Standard AC Auger Cuttings Phone: 317-585-8277 - Hand Auger Penetration Test

		TES	T BOR	ING I	RECC	ORD)					-		
CLIEN	νT	: Indiana Department of Transportation							BO	RING NO).:	TB	-2	
PROJ	ECT	: SR 15 from 0.34 mi. S. of US 20 to 1.92 n	ni. N. of US 2	20			_		SHE	EET	1	0	F	<u>1</u>
LOCA	LOCATION : Elkhart County, Indiana								DAT	TE STAF	RTED	: 10-2	25-05	
DES	NO.	: 8354420; Project No.: STP-4320; CTL No	.: 050500451	ND					DAT	TE COM	PLETED	: 10-2	25-05	
BORI	NG ELE	VATION : 250.70 m (USC&GS)	BORING M	ETHOD	: HSA				HAN	MMER	:_ <u>/</u>	Automa	atic	
1		TION : 13+885	RIG TYPE		: CME-5	50 AT	V		DRI	LLER	: <u> </u> E	D		
{	LINE	SET : 1.5m Lt : "C" & "B"	CASING DI	A.	: <u>83 mm</u>	I.D.			TEN	MPERAT	URE : 5	ю° F		
<u> </u>	DEF		CORE SIZE		<u>:</u>				WE	ATHER	: 8	Sunny		
GRO	JNDWAT	ER: Lencountered at 2.74 m	At Completic	on <u>1.70 i</u>	<u>m</u>								п at <u>2.</u>	<u>44 m</u>
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	N.	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m²)	Unconfined Compression (kN/m²)	A	tterbe Limits	
		100 1 T 00 100 FTF /407 \ 0.1			SZ	S.	100	æ	žŏ	P≷₹	50	LL	PL	PI
250.57 250.47	<u>'</u>	ASPHALT CONCRETE (127mm) (Visual) CEMENT CONCRETE (102mm) (Visual)	XX	0.13 0.23		İ		1						Ì
		Brown, Slightly Moist, Medium Dense, SAN GRAVEL (FILL) (Visual)	ľoʻ -	,	\$5-1	8 9 10	19	78 		 		, 		
249.63	1.5	Brownish Gray, Molst, Medium Dense, SA with Traces of Brick Fragments (FILL) (Visual)		1.07	SS-2	8 8 6	14	89						
248.87		Brown, Moist, Very Stiff, SANDY LOAM with Traces of Brick Fragments (FILL) A-4 As Lab 1	th	1.83	SS-3	11 14 16	30	33	14					
248.1	3.0			2.59	SS-4	8 10 12	22	100				1 H5 1 H5 1 H5 1 H5		
	4.5	Brown, Moist to Wet, Medium Dense, SAN (Visual)	ID .		SS-5	6 8 9	17	100						
244.6	6.0_	Bottom of Boring at 6.10 meters		6.10	SS-6	4 5 6	11	100						
		Boring performed for Structure No. 62. Two attempts made on SS-3 due to low so recovery. Boring backfilled with soil cuttings, and pavement restored with concrete patch.	pil											
		<i></i>		IG MET			AMPL						TIONS	
	CT! Pho	ENGINEERING & L Engineering of Indiana, Inc. one: 317-585-8277	HSA - Holi SFA - Soli RC - Roo MD - Muc WD - Was	d Flight / k Coring I Drilling sh Drillin	Auger g	SS ST CR BS AC	- Roo	lby Tu k Core Samp	be Sa Sam ole	mple L ple P	L - Liq PL - Pla PI - Pla SPT - Sta	uid Lir astic Li asticity	imit Index 1	¢

TEST BORING RECORD **TB-3** CLIENT : Indiana Department of Transportation BORING NO.: **PROJECT** : SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20 SHEET OF 1 LOCATION : Elkhart County, Indiana DATE STARTED : 10-25-05 8354420; Project No.: STP-4320; CTL No.: 05050045IND DATE COMPLETED: 10-25-05 DES NO. BORING ELEVATION: 261.15 m (USC&GS) **BORING METHOD: HSA** HAMMER : Automatic STATION 5+696 : CME-550 ATV DRILLER **RIG TYPE** : ED **OFFSET** 10.7m Rt CASING DIA. TEMPERATURE: 50° F : 83 mm I.D. LINE "S-US20-B" DEPTH 6.10 m CORE SIZE WEATHER : Cloudy At Completion 5.49 m GROUNDWATER: Encountered at 3.96 m Caved in at <u>5.56 m</u> Unconfined Compression (kN/m²) Moisture Content (%) SPT / 15cm Ę Atterberg Total Unit Weight (kg/m³) Stratum Elevation Recovery (%) Limits SPT/30 SOIL/MATERIAL DESCRIPTION Sample Depth Ē PL ΡI TOPSOIL (254mm) (Visual) 260.90 0.25 2 **SS-1** 2 4 78 Brown, Moist, Very Loose, SAND with Traces 2 of Roots (Possible Fill) (Visual) 259.93 1.22 SS-2T 2 3 89 Dark Brownish Black, Moist, Very Soft, SILTY SS-2B 47 CLAY with Little Organic Matter (Creek 2 Sediments) (Visual) Organic Matter = 10.8% 259.32 1.83 Brown with Gray Streaks, Very Moist, Soft, SANDY LOAM with Traces of Roots (Creek **SS-3** 4 78 12 NP NΡ NP Sediments) 2 A-4 (0) Lab 1 258.56 2.59 2 **SS-4** 2 5 78 14 22 12 10 3.0 Gray, Moist, Soft, CLAY LOAM (TILL) A-4 (3) Lab 2 257.19▼ 3.96 **SS-5** 100 5 11 Gray, Wet, Medium Dense, SAND 255.97_ 5.18 ++ Gray, Moist, Medium Dense, SILT + + + (Visual) +++ **SS-6** 6 14 100 18 6.0 +++ 255.05 6.10 Bottom of Boring at 6.10 meters Boring performed for Structure No. 69. Boring backfilled with soil cuttings. **BORING METHOD** SAMPLING METHOD **ABBREVIATIONS** HSA - Hollow Stem Auger - Split Spoon Sample - Hand Penetrometer - Shelby Tube Sample SFA - Solid Flight Auger LL - Liquid Limit ST - Rock Core Sample RC - Rock Coring CR PL - Plastic Limit MD - Mud Drilling - Plasticity Index BS - Bag Sample CTL Engineering of Indiana, Inc. WD - Wash Drilling AC - Auger Cuttings SPT - Standard Phone: 317-585-8277 HA - Hand Auger Penetration Test

APPENDIX C

LABORATORY TEST RESULTS

Summary of Classification Test Results Grain Size Distribution Curves Summary of Special Laboratory Test Results

Sample No. Station Offset Line No. Soil	ent				
Station Offset Line No. 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Clay Loam A-4 (3) 97.5 90.6 63.4 2.5 34.0 Porth No. 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Clay Loam A-4 (3) 97.5 90.6 63.4 2.5 34.0 40.4 2.5 34.	Resili Modu	isd)			
Station Offset Line No. 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Clay Loam A-4 (3) 97.5 90.6 63.4 2.5 34.0 Loam Station Station Size Distribution Station Grain Size Distribution (%) (%) (%) (%) (%) (%) (%) (%) (%) (%)	Optimum Moisture Content	(%)			
Station Offset Line No. 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Clay Loam A-4 (3) 97.5 90.6 63.4 2.5 34.0 Loam Station Station Size Distribution Station Grain Size Distribution (%) (%) (%) (%) (%) (%) (%) (%) (%) (%)	Max. Dry Density	(pct)			ŀ
Station Offset Line No. 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Clay Loam A-4 (3) 97.5 90.6 63.4 2.5 34.0 Depth No. 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Clay Loam A-4 (3) 97.5 90.6 63.4 2.5 34.0 40.4 2.5 34.			NP	10	
Station Offset Line No. 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Clay Loam A-4 (3) 97.5 90.6 63.4 2.5 34.0 Loam Station Station Size Distribution Station Grain Size Distribution (%) (%) (%) (%) (%) (%) (%) (%) (%) (%)			dN	12	ļ
Station Offset Line No. 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Clay Loam A-4 (3) 97.5 90.6 63.4 2.5 34.0 Loam Station Station Size Distribution Station Grain Size Distribution (%) (%) (%) (%) (%) (%) (%) (%) (%) (%)	۲		NΡ	22	
Station Offset Line No. 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Clay Loam A-4 (3) 97.5 90.6 63.4 2.5 34.0 Loam Station Station Size Distribution Station Grain Size Distribution (%) (%) (%) (%) (%) (%) (%) (%) (%) (%)	<u></u>		12	14	l
Station Offset Line Sample No. Depth Class 5+696 10.7m Rt "S-US20-B" SS-3 1.83-2.29 Sand 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Class	tion	Clay	11.4	23.1	
Station Offset Line Sample No. Depth Class 5+696 10.7m Rt "S-US20-B" SS-3 1.83-2.29 Sand 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Class	stribu	Silt	29.2	40.4	
Station Offset Line Sample No. Depth Class 5+696 10.7m Rt "S-US20-B" SS-3 1.83-2.29 Sand 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Class	Size Di (%)	Sand	47.7	34.0	
Station Offset Line Sample No. Depth Class 5+696 10.7m Rt "S-US20-B" SS-3 1.83-2.29 Sand 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Class	Grain (Sravel	11.7	2.5	
Station Offset Line Sample No. Depth Class 5+696 10.7m Rt "S-US20-B" SS-3 1.83-2.29 Sand 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Class	ssing o.)	200	40.6	63.4	
Station Offset Line Sample No. Depth Class 5+696 10.7m Rt "S-US20-B" SS-3 1.83-2.29 Sand 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Class	eve N	40	77.3	90.6	
Station Offset Line Sample No. Depth Class 5+696 10.7m Rt "S-US20-B" SS-3 1.83-2.29 Sand 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Class	Perce (Si	10	88.3	97.5	
Station Offset Line Sample No. Depth Class 5+696 10.7m Rt "S-US20-B" SS-3 1.83-2.29 Sand 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Class	ASHTO		A-4 (0)	A-4 (3)	
Station Offset Line Sample No. 5+696 10.7m Rt "S-US20-B" SS-3 5+696 10.7m Rt "S-US20-B" SS-4	Soil	Classification	Sandy Loam	Clay Loam	
Station Offset Line Sample No. 5+696 10.7m Rt "S-US20-B" SS-3 5+696 10.7m Rt "S-US20-B" SS-4	Depth	-	1.83-2.29	2.59-3.05	
Boring No. Lab No. Station Station Offset Cline Cline Line Cline TB-3 Lab 1 5+696 10.7m Rt "S-US20-B" TB-3 Lab 2 5+696 10.7m Rt "S-US20-B"	Sample	2	SS-3	SS-4	
Boring No. Lab No. Station Station Offset TB-3 Lab 1 5+696 10.7m Rt TB-3 Lab 2 5+696 10.7m Rt	Line		"S-US20-B"	"S-US20-B"	
Boring Lab Station No. No. TB-3 Lab 1 5+696 TB-3 Lab 2 5+696	Offset		10.7m Rt	10.7m Rt	
Boring Lab No. No. TB-3 Lab 1 TB-3 Lab 2	Station		969+9	969+9	
Boring No. TB-3 TB-3	Lab	<u>.</u>	Lab 1	Lab 2	
	Boring		TB-3	TB-3	



SUMMARY OF CLASSIFICATION TEST RESULTS

Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

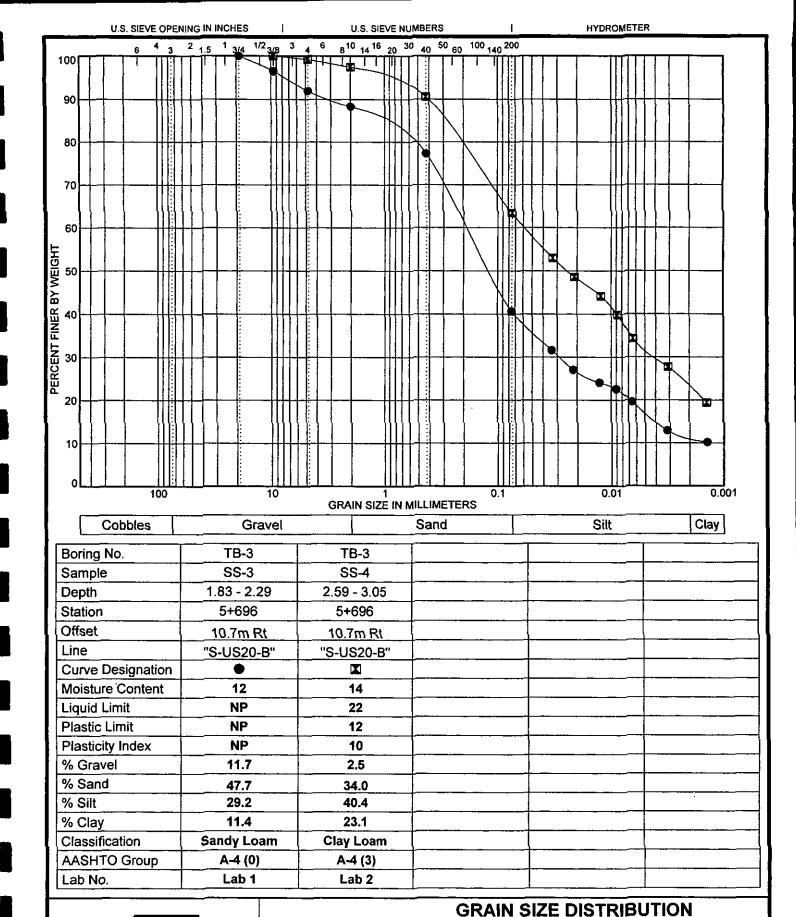
Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

CTL Engineering of Indiana, Inc.
Phone: (317) 585-8277

Phone: (317) 585-8277

INDOT_CLASSIFICATION_METRIC 05050045_SR2045R15.GPJ CTL.GDT 11/2306





Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

CTL Engineering of Indiana, Inc. Phone: 317-585-8277

Sheet 1 of 1

Boring No.	Station	Offset	Line	Sample No.	Depth (m)	Moisture Content (%)	Loss on Ignition (%)	рH
TB-1	13+877	10.7m Rt	"C" & "B"	SS-1	0.30-0.76	23		
TB-1	13+877	10.7m Rt	"C" & "B"	SS-6	5.64-6.10	15		
TB-2	13+885	1.5m Lt	"C" & "B"	SS-3	1.83-2.29	14		
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-2B	1.22-1.52	47	10.8	
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-3	1.83-2.29	12		8.4
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-4	2.59-3.05	14		8.7
ТВ-3	5+696	10.7m Rt	"S-US20-B"	SS-6	5.64-6.10	18		
								<u>-</u>

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

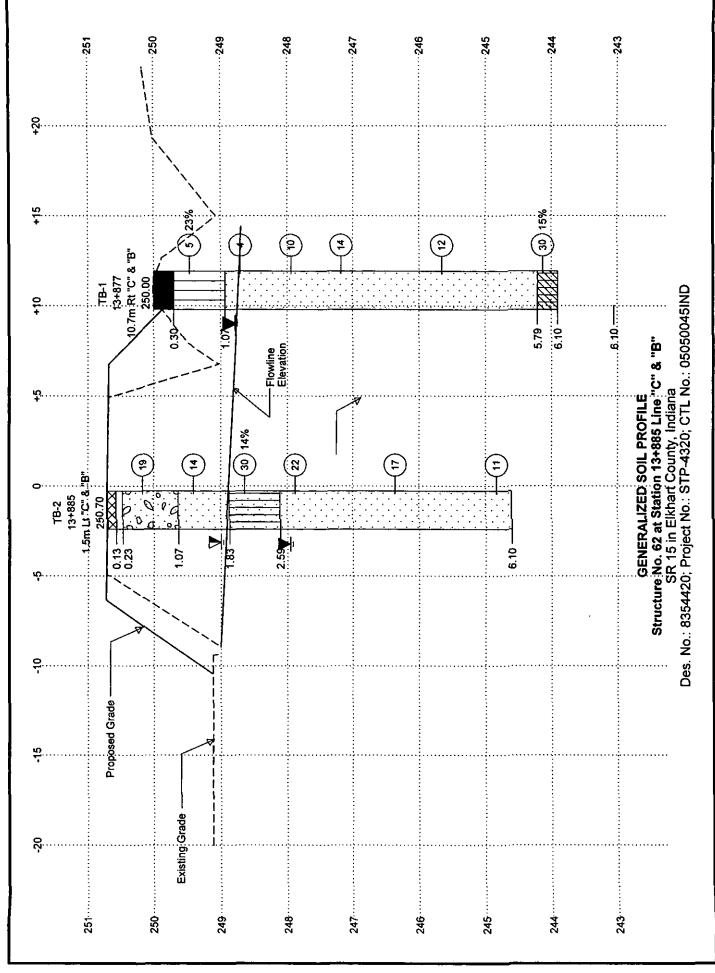
Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

CTL Engineering of Indiana, Inc. Phone: (317) 585-8277

APPENDIX D

Structure No. 62
Generalized Soil Profile
Soil Bearing Capacity Analysis



INDOT_METRIC_N 05050045_TEMP.GPJ CTL.GDT 11/23/05

BEARING CAPACITY ANALYSES

Culvert .:

Box Culvert

Location:

SR 15 in Elkhart County

Structure No.: 62, 25m of 1194mm x 1804m Pipe (Boring No. TB-1 and TB-2)

Des. No.:

8354420

CTL No.:

05050045IND

SOIL BEARING CAPACITY

1. Very loose sand or very stiff sandy loam in-place fill exist below the proposed culvert. It is recommended that the in-place fill be removed and replaced with "B" Borrow to maintain uniform base for the culvert. Note that the 30 bpf encountered in the sandy loam fill may be due to striking on brick fragments. This value may not be represent the consistency of the entire in-place fill.

1. Footings for wingwalls would be founded on loose to medium dense sand with:

N = 4 to 22 bpf

Estimated Phi = 29 deg., C = 0, G = 115 pcf & $G_{sub} = 115 - 62 = 53$ pcf

2. Water expected above footings (longterm)

3. Assume depth of footings,

D_f = At 4' below flow line, and

B = 2'

B = 3

B = 4'

B = 5'

B = 6

Ultimate Bearing Capacity,

qult = c Nc + (Gsub Df Nq) + (0.5 Gsub B NGamma)

Allowable Bearing Capacity,

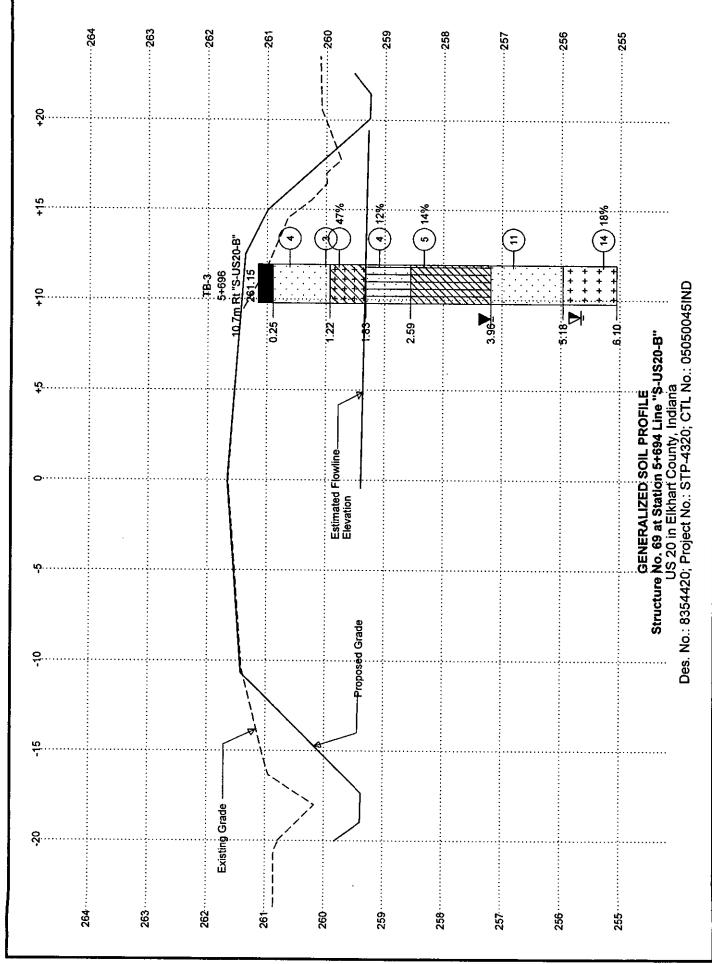
qall = (qult - Gsub Df) / FS

Phi (degrees)	c (psf)	N _c	N _q	N _{Gamma}	D _f (feet)	В	G (pcf)	G _{sub}	FS	Q _{ult} (psf)	Q _{all} (psf)	USE Qall (psf)
29	0	27.86	16.44	19.34	4	2	115	53	3	4510	1433	1400
29	0	27.86	16.44	19.34	4	3	115	53	3	5023	1604	1600
29	0	27.86	16.44	19.34	4	4	115	53	3	5535	1845	1800
29	0	27.86	16.44	19.34	4	5	115	53	3	6048	2016	2000
29	0	27.86	16.44	19.34	4	6	115	53	3	6560	2187	2100

N_c, N_q, N_{Gamma} after Meyerhof

APPENDIX E

Structure No. 69
Generalized Soil Profile
Soil Bearing Capacity Analysis



INDOT_METRIC_N 05050045_TEMP.GPJ CTL.GDT 11/23/05

BEARING CAPACITY ANALYSES

Culvert .:

Box Culvert

Location:

US 20 in Elkhart County

Structure No.: 69, 6.0m of 3910mm x 2235mm Multi Plate Box Culvert (Boring No.: TB-3)

Des. No.:

8354420

CTL No.:

05050045IND

DATA

1. Box Culvert extending 6.0 meters to the right of Line "S-US20-B"

2. Invert Elevation = 260.3 (assumed). It is recommended that all creek sediment and/or soils with organic matter be removed to Elevation 258.5. The excavation should be backfilled with compacted No. 53 aggregate. A layer of geogrid Type 1 would be needed at the bottom of the excavation.

3. Groundwater is not expected. However, runoff and/or seepage water could be present.

SOIL BEARING CAPACITY

The soil bearing capacity provided below could be used for wingwall footings. It is assumed that footings will be constructed onto the clay loam soils.

Qu = 1200 psf (Estimated based on blowcounts). Cu = 1200 / 2 = 600 psfFor Phi = 0, Nc = 5.14 (Meyerhof)

Ultimate Bearing Capacity,

 $quit = c Nc = 600 \times 5.14 = 3084 psf$

Allowable Bearing Capacity, qall = qult / FS = 3084 / 3.0 = 1028 psf

USE gall = 1000 psf



Indiana Department of Transportation

Materials and Tests Division

120 South Shortridge Road P. O. Box 19389Indianapolis, Indiana 46219-0389Phone: (317) 610-7251 Fax: (317) 356-9351

March 3, 2004

Mr. Gerald Mroczka, Chief Design Division N642 - IGCN

Attn: Ms. Sally Chesney

Project Coordinator

Subject:

Subsurface Investigation - Addendum 1

Des No: 8354420

Project No: STP-4320 (3)

Proposed Storm Sewer Line, SR 15 Road Rehabilitation

County: Elkhart District: Fort Wayne

Gentlemen:

The additional Geotechnical Investigation for the subject project has been completed and copies of the Geotechnical Report are being forwarded to those listed below.

If you have any questions concerning this matter, please call us.

Very truly yours,

Athar A. Khan.

Chief Geotechnical Engineer

Somanath S. Hiremath

Geotechnical Engineering Group Leader

SSH/SS

cc: Mr. T. Seeman – Attn: Mr. W. Smith - Attachment

Mr. D. Sturtz – Attn: Mr. J. Keefer – Attachment (2)

Mr. D. Cohen – Attachment

Ms. J. Somers – Attachment

Mr. J. Paauwe - Attachment

File

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SUBSURFACE INVESTIGATION ADDENDUM 1 DES. NO.: 8354420 PROJECT NO.: STP-4320 (3)

PROPOSED STORM SEWER LINE SR 15 FROM 0.56 KM S. OF US 20 TO A POINT 3.10 KM N. OF US 20 ELKHART COUNTY CTL PROJECT NO.: 00-050061

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION MATERIALS AND TESTS DIVISION 120 SOUTH SHORTRIDGE ROAD INDIANAPOLIS, INDIANA 46219

PREPARED BY:

CTL ENGINEERING OF INDIANA, INC. 6848 HILLSDALE COURT INDIANAPOLIS, INDIANA 46250

FEBRUARY, 2004



CTL Engineering of Indiana, Inc.

6848 Hillsdale Court, Indianapolis, Indiana 46250

Phone: 317/585-8277 • Fax: 317/585-8621

e-mail: ctlin@ctleng.com

AN EMPLOYEE OWNED COMPANY



Established 1927

Consulting Engineers • Testing • Inspection Services • Analytical Laboratories

February 4, 2004

Indiana Department of Transportation Materials and Tests Division 120 South Shortridge Road Indianapolis, Indiana 46219

Attention:

Athar Khan, P.E.

Chief Geotechnical Engineer

Reference:

Subsurface Investigation - Addendum 1

Des. No.: 8354420

Project No.: STP-4320 (3) Proposed Storm Sewer Line

SR 15 from 0.56 km S. of US 20 to a point 3.10 km N. of US 20

Elkhart County

CTL Project No. 00-050061

Dear Mr. Khan:

In accordance with your authorization to proceed, CTL Engineering, Inc. has completed the subsurface investigation study on the above referenced site.

This addendum report includes the results of our field and laboratory testing, analyses and estimated soil parameters for the proposed storm sewer line.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

ali larath

cc: Mr. Mr. Som Hiremath, P.E., INDOT - Materials and Tests Division

Offices: Ohio, Indiana, North Carolina, West Virginia

SUMMARY OF SUBSURFACE INVESTIGATION - ADDENDUM 1

The project is located on the west side of SR 15 between 283m (929') south of US 20 and 220m (722') north of US 20 in Elkhart County. The project involves design and construction of a new storm sewer line approximately 503m (1650') in length placed at depths of approximately 0.5m to 5.0m (2' to 16.5') beneath existing grade. The storm sewer will be 900mm to 1050mm in diameter.

A subsurface investigation for the subject project has been completed and a summary of our findings and recommendations is reported below. Detailed foundation recommendations and construction considerations are provided in the subsurface investigation report.

- 1. The test borings indicate that the underlying soil conditions are suitable for the construction of the proposed storm sewer line which would bear on sandy loam tills, and on sand at the outlet location.
- 2. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment.
- 3. The test borings indicated that groundwater or trapped water is contained in the sand seams or layers embedded within the till deposits.
- 4. Groundwater may be encountered in isolated locations depending upon the depth of the sand layers within the till deposits. Note that the test borings were drilled in October where the groundwater may have been at its lowest level. Therefore, the groundwater may be encountered at higher elevations depending upon time of construction and amount of precipitation. Dewatering in open cut excavations may be accomplished using a dewatering system suggested by the Contractor and approved by the engineer.
- 5. For open cut methods, excavations in excess of 4.0 feet in depth should be sloped and or shored according to OSHA requirements. Preliminary analysis indicates that excavations extending to the proposed invert elevations may be laid back at a slope rate no steeper than 3/4:1 (Horizontal to Vertical). If excavations cannot be sloped as recommended, the excavated sidewalls should be shored using a trench box system using the estimated soil parameters shown in Table 2 of the subsurface investigation report.
- 6. On-site excavated soils, except topsoil, are considered suitable for use for backfill provided proper moisture content is maintained during placement.
- 7. Pipe installation, trench width, bedding and backfill compaction should be performed in accordance with ISS.
- 8. Directional drilling should be possible at this site. Additional test borings may be needed to confirm the soil conditions.



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Subsurface Investigation Addendum 1 Proposed Storm Sewer Line

Des. No.: 8354420, Project No.: STP-4320 (3)

CTL Project No.: 00-050061

February 4, 2004

Page 1

I. PROJECT LOCATION AND DESCRIPTION

The project is located on the west side of SR 15 between 283m (929') south of US 20 and 220m (722') north of US 20 in Elkhart County, Indiana. The project involves the design and construction of a new storm sewer line between stations 10+117 and 10+620 for approximately 503m (1650'). The storm sewer will be 900mm to 1050mm in diameter.

Based upon the site plans provided by INDOT, the proposed storm sewer line will be constructed at invert elevations ranging from 260.95m at station 10+620 to 257.35 at station 10+117. Review of available X-sections for this project revealed that the storm sewer will be installed at depths of approximately 0.5m to 5.0m (2' to 16.5') beneath existing grade. We have assumed the storm sewer line will be constructed using conventional open cut excavation method. Also, we assumed directional drilling may be used where the storm line crosses US 20.

II. SUBSURFACE INVESTIGATION

Three (3) additional soil test borings, designated as SSL-1, SSL-2 and SSL-3, were drilled for this supplemental investigation at the locations shown on the enclosed test boring records. These test borings were drilled to depths ranging from 4.57m to 9.14m (15' to 30'). We have included in this report 5 borings that were drilled in 2001 for SR15/US20 roadway improvements and for a box culvert at station 10+122. These borings are designated as RB-3, RB-4, RB-5, TB-1 and TB-2,

The current test borings were advanced with an All-Terrain-Vehicle (ATV) mounted drilling machine utilizing hollow stem augers (HSA) on October 23, 2003. Standard Penetration tests were conducted using a 140-pound automatic hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches.

Drilling, sampling, field and laboratory testing have been performed according to standard geotechnical engineering practices, INDOT and current ASTM procedures. Results from field and laboratory tests are shown on the enclosed boring records and soil profile.

Soil samples obtained from the drilling operation were preserved in glass jars, visually classified in the field and laboratory. Representative soil samples were tested for natural moisture content, Atterberg limits, grain size distribution, unconfined compression and pH.

Locations and ground surface elevations of the test borings were interpolated from the site plans provided by INDOT.



Subsurface Investigation Addendum 1 Proposed Storm Sewer Line

Des. No.: 8354420, Project No.: STP-4320 (3)

CTL Project No.: 00-050061

February 4, 2004

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III. <u>FINDINGS</u>

The subsurface findings presented in this section are based upon the test borings drilled in 2003. The test borings drilled in 2001 are included in this report for additional information.

The test borings drilled along the proposed storm sewer line exhibited 3 to 12 inches (75 to 150mm) of topsoil at the surface.

Beneath the surface cover, SSL-1 through SSL-3 encountered mainly glacial till deposits described as sandy loam. Seams and/or layers of sand were encountered in isolated locations within the till deposits. TB-2 drilled near the proposed line outlet exhibited sand deposits throughout the drilled depth.

Standard penetration blowcount values ranged from 4 to 31 blows per foot (bpf) with natural moisture content values of 7 to 22 percent.

Groundwater and soil cave-in depths were recorded during the field investigation as shown in Table 1. Refer to the enclosed test boring records for information about the soils and groundwater encountered during this investigation.

Table 1 - Groundwater Level

Table 1 - Groundwater Zever										
	During	Drilling	At Cor	mpletion	At 24	Cave-in				
Boring No.	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	Depth (m)			
RB-3	Dry	3	1.75	259.7	Dry		1.78			
RB-4	0.91*	174.0*	2.51*	262.5*	0.91	264.1*	1.68			
RB-5	Dry		Dry		Dry		2.29			
TB-1	1.68	256.0	1.83	255.8	1.83	255.8	3.58			
TB-2	1.83	255.2	1.52	255.5	0.91	256.1	1.22			
SSL-1	Dry		Dry		Dry					
SSL-2	8.53	256.0	5.64	258.9	5.49	259.0				
SSL-3	3.96	258.5	1.68	260.8	1.52	261.0	2.44			

^{*} Possible trapped water in gravel base due to rain or surface runoff



Subsurface Investigation Addendum 1 Proposed Storm Sewer Line

Des. No.: 8354420, Project No.: STP-4320 (3)

CTL Project No.: 00-050061

February 4, 2004 Page 3

IV. ANALYSIS AND RECOMMENDATIONS

The test borings indicate that the underlying soil conditions are suitable for the construction of the proposed storm sewer line. Generally, the storm sewer pipe would bear on sandy loam tills or sand at the outlet location. Based upon the above considerations and the soil data obtained from the field testing, the following recommendations are provided.

- 1. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment. Generally, the soils at the proposed invert elevations of the pipe are expected to be medium stiff to stiff. However, due to removal of 16 feet of soil overburden, soft or loose soils may be encountered at or below the invert level in a form of soil swelling and/or liquefaction "boiling condition". In such an event, the soft/loose soils should be compacted or removed and replaced with suitable fill materials, or as otherwise directed by the Engineer.
- 2. The test borings indicated that groundwater or trapped water is contained in the sand seams or layers embedded within the till deposits. Based upon the groundwater levels observed during the field investigation and natural moisture content values of the recovered soil samples, groundwater may be encountered in isolated locations depending upon the depth of the sand layers within the till deposits. Note that the test borings were drilled in October where the groundwater may be at its lowest level. Therefore, the groundwater may be encountered at higher elevations depending upon time of construction and amount of precipitation. Dewatering in open cut excavations may be accomplished using sump pumps, well point system, or any dewatering system suggested by the Contractor and approved by the engineer.
- 3. For open cut methods, excavations in excess of 4.0 feet in depth should be sloped and or shored according to OSHA requirements. Preliminary analysis indicates that excavations extending to the proposed invert elevations may be laid back at a slope rate no steeper than 3/4:1 (Horizontal to Vertical).

The recommended slope rates may be modified during construction depending upon groundwater levels and sand deposits within the glacial tills. The excavated side slope should be observed and approved during construction by an experienced Registered Engineer.

If excavations cannot be sloped as recommended, the excavated sidewalls should be shored using a trench box system, or equivalent. The estimated soil parameters shown in Table 2 below may be used in designing the shoring system. The effects of surcharge loads from construction equipment, traffic and soil stockpiled adjacent to the excavated sidewalls should be considered in the design of the shoring system.



Subsurface Investigation Addendum 1 Proposed Storm Sewer Line

Des. No.: 8354420, Project No.: STP-4320 (3)

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February 4, 2004

Page 4

Table 2 – Estimated Soil Parameters for Shoring Design

	N	Materials Typ	oe .
Soil Parameters	In-place	Sand Loam	Sand/Sand
	Fill	(Till)	& Gravel
m + 1 x x '4 x x x - 1 - 1 - 4 - 2 - (1 - 2 / 4 - 3)	120	135	125
Total Unit Weight, pcf (kg/m³)	(1925)	(2160)	(2000)
$\frac{1}{1} = \frac{1}{1} $	0	3000	0
Undrained Shear Strength where $Ø = 0^{\circ}$, psf (kN/m ²)	U	(145)	0
(C.1	0	600	0
Cohesion, psf (kN/m²)	0	(29)	U
Angle of Internal Friction (Ø), Degrees	30	25	32
At Rest Pressure, Ko	0.50	0.58	0.47
Active Pressure, Ka	0.33	0.41	0.31
Passive Pressure, Kp	3.00	2.46	3.25

- On-site excavated soils, except topsoil, are considered suitable for use for backfill provided proper moisture content is maintained during placement. A portion of the excavated soils may exhibit natural moisture content values above the optimum moisture. Such soils may require air-drying or other methods. Additional fill, if required, may consist of sandy silt, sand and gravel materials, flowable fill, or as otherwise directed by the Engineer.
- 6. Backfill materials should be placed and compacted in accordance with INDOT Standard Specifications. The engineered fill should not be placed in a frozen condition or over a frozen subgrade.
- 7. Pipe installation, trench width, bedding and backfill compaction should be performed in accordance with ISS.
- 8. Directional drilling should be possible at this site. Additional test borings may be needed to confirm the soil conditions in the area of the directional drilling operations are similar to those encountered in borings SSL-1 and SSL-2.



Subsurface Investigation Addendum 1 Proposed Storm Sewer Line

Des. No.: 8354420, Project No.: STP-4320 (3)

CTL Project No.: 00-050061

February 4, 2004

Page 5

V. CHANGED CONDITIONS

Should details of the proposed storm sewer line be changed from those used in preparing this report, CTL should be notified to make the necessary modifications in our recommendations to account for the changed conditions.

VI. TESTING AND OBSERVATION

Experience shows that underlying soil conditions in an area sometimes vary from the ones indicated in the borings at their specific locations. It is therefore recommended that a Soils Engineering Technician, under the supervision of a qualified Geotechnical Engineer, be retained on site to observe all excavations, soils at bottom of excavations and placement of backfill.

VII. CLOSURE

CTL has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analysis, conclusions and other work product of CTL are instruments of service for this project only.

Soil samples will be retained in our laboratory for 60 days, after which they will be discarded unless instructions are received from you as to their disposal.

CTL's assignment does not include, nor does this geotechnical report address, the environmental aspects of the particular site.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

Indiana Reg. No. 60900551

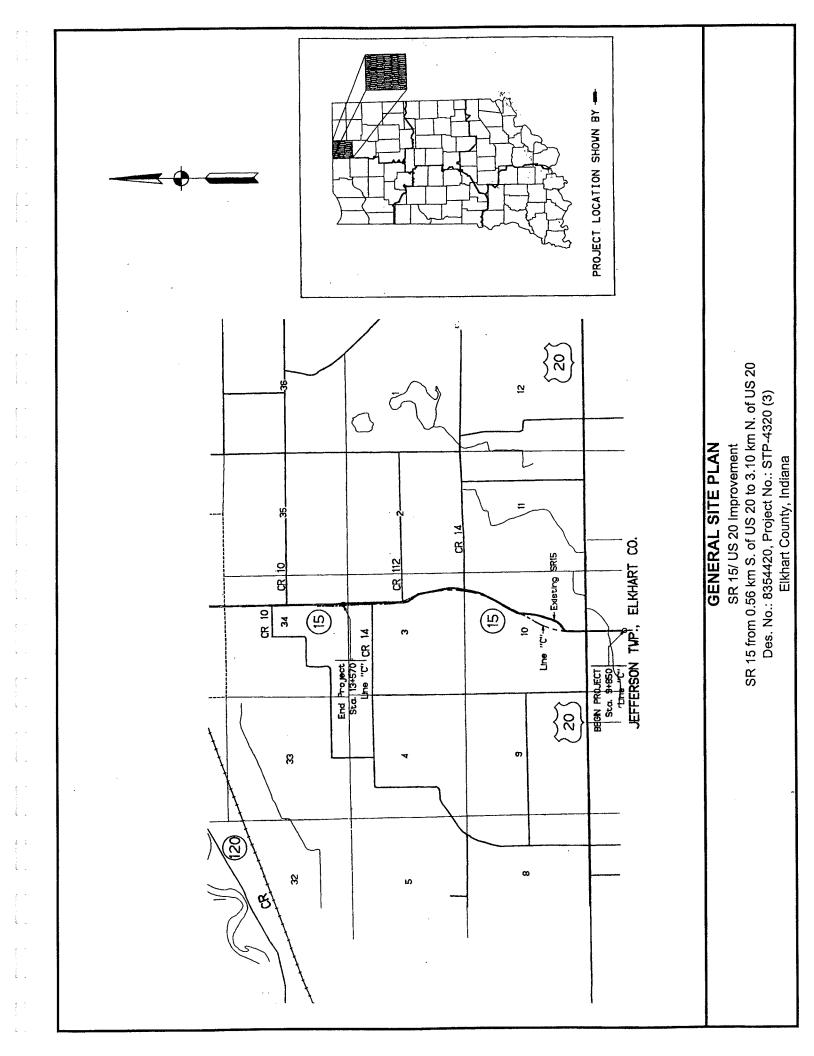
WAR STATE OF
Paul L. Douglass, P.E. Principal Engineer

Indiana Reg. No. 60012388



APPENDIX A GENERAL SITE PLAN





APPENDIX B TEST BORING RECORDS



SOIL DESCRIPTION

NON-COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Loose	6 - 10 11 - 30 31 - 50
COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Soft	
GRADATION COMPONENT	SIZE
Boulders	assing 8" Retained on 3" ssing 3" Retained on #10 ing #10 Retained on #40 on #40 Retained on #200 . 0.075 mm to 0.002 mm
MOISTURE TERMS	DESCRIPTION
Dry	Below Plastic ve Plastic, Below LiquidAt Liquid



TEST BORING RECORD SSL-1 BORING NO.: CLIENT : Indiana Department of Transportation SHEET OF **PROJECT** : Proposed Storm Sewer Line DATE STARTED : 10-23-03 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co. LOCATION : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DATE COMPLETED: 10-24-03 DES NO. **HAMMER** BORING ELEVATION: 262.5 m USC&GS **BORING METHOD: HSA** : Automatic **STATION** : 10+293 : CME 55 Truck DRILLER : TN **RIG TYPE** : 15 m Lt **OFFSET** TEMPERATURE : High 60's ° F : 83 mm CASING DIA. "B" LINE **CORE SIZE** WEATHER : Cloudy 1.67 m **DEPTH** At Completion Dry Caved in at m ▼ Encountered at <u>Dry</u> GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) Ë Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Stratum Elevation Limits SPT/ 30 (N) SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Depth PL ы 0.15 262.35 TOPSOIL (150mm) (Visual) 4 SS-1 4 13 22 12 10 10 100 6 Brown, Slightly Moist, Medium Stiff to Very Stiff, SANDY LOAM with Gray Streaks in SS-2 A-4 (1) 5 Lab 1 SS-2 8 19 100 11 1.5 1.83 260.67 5 7 **SS-3** 22 12 10 16 100 11 9 5 383 SS-4 7 17 100 11 2235 @ 15.0% 3.0 10 Brown Changing to Gray, Damp, Very Stiff to Stiff, SANDY LOAM (TILL) A-4 (1) Lab 2 SS-5 6 13 100 12 7 5 5.18 257.32 SS-6 3 8 100 22 Gray, Moist, Medium Stiff, CLAY LOAM 5 5.49 (Visual) 257.01 Bottom of Boring at 5.14 meters (18') **NOTES** 6.0 Temporary slotted PVC pipe set at 18 feet 2. Boring backfilled with soil cuttings. **SAMPLING METHOD ABBREVIATIONS BORING METHOD** CTL Engineering of Indiana, Inc. SS - Split Spoon Sample - Hand Penetrometer HSA - Hollow Stem Auger 6848 Hillsdale Court SFA - Solid Flight Auger ST - Shelby Tube Sample - Liquid Limit Indianapolis, Indiana 46250 CR - Rock Core Sample - Plastic Limit RC - Rock Coring MD - Mud Drilling BS - Bag Sample - Plasticity Index Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC - Auger Cuttings Fax: 317-585-8621 HA - Hand Auger Penetration Test

TEST BORING RECORD SSL-2 BORING NO.: CLIENT : Indiana Department of Transportation SHEET OF : Proposed Storm Sewer Line **PROJECT** DATE STARTED : 10-23-03 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co. LOCATION DATE COMPLETED: 10-24-03 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic BORING ELEVATION: 264.5 m USC&GS BORING METHOD: HSA **STATION** : 10+473 DRILLER : TN : CME 55 Truck **RIG TYPE OFFSET** 15 m Lt TEMPERATURE: High 60's ° F CASING DIA. : 83 mm "B" LINE WEATHER : Cloudy **CORE SIZE DEPTH** 2.79 m At Completion 5.64 m $\sqrt{2}$ 24 hours Reading 5.49 m Caved in at m GROUNDWATER: Encountered at 8.53 m Unconfined Compression (kN/m²) Moisture Content (%) Atterberg E SPT / 15cm Recovery (%) Total Unit Weight (kg/m³) Stratum Elevation Limits SPT/ 30 (N) Stratum Depth Sample Number SOIL/MATERIAL DESCRIPTION Sample Depth LL PL ы 0.15 264.35 TOPSOIL (150mm) (Visual) 2 SS-1 3 10 100 11 7 6 569 2120 @ 11.1% SS-2 7 17 100 11 10 1.5 Brown, Slightly Moist, Medium Stiff to Very 7 **SS-3** 18 67 Stiff, SANDY LOAM (TILL) with Sand Seams in SS-4 11 A-4 As Lab 2 3 SS-4 5 12 67 12 3.0 7 4 4.27 260.23 100 **SS-5** 3 13 10 Gray, Slightly Moist to Moist, Medium Stiff to Hard, SANDY LOAM (TILL) A-4 As Lab 2 SS-6 3 7 100 19 6.0 4 Continued on next page SAMPLING METHOD **ABBREVIATIONS BORING METHOD** CTL Engineering of Indiana, Inc. - Split Spoon Sample - Hand Penetrometer SS HSA - Hollow Stem Auger 6848 Hillsdale Court - Shelby Tube Sample - Liquid Limit SFA - Solid Flight Auger ST LL - Rock Core Sample PL - Plastic Limit Indianapolis, Indiana 46250 RC - Rock Coring CR ы MD - Mud Drilling BS - Bag Sample - Plasticity Index Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC Auger Cuttings Fax: 317-585-8621 Penetration Test HA - Hand Auger

		TEST	T BORII	NG F	RECC	RD								
CLIEN	г	: Indiana Department of Transportation							BOF	RING NO	.:	SSI	2	
PROJE		: Proposed Storm Sewer Line						·	SHE	ET	2	0	F :	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)		tterber Limits	g
Str	Sar			Str	Sa	Ω.	ις.	S.	≚ິວ	₽¥¥	50	LL	PL	PI
255.81_ 255.51_ 255.36_	9.0	Gray, Slightly Moist to Moist, Medium Stiff to Hard, SANDY LOAM (TILL) A-4 As Lab 2 Brown, Wet, Medium Dense, SAND (Visual) Gray, Wet, Very Stiff, SANDY LOAM (TILL) (Visual) Bottom of Boring at 9.14 meters (30') NOTES 1. Temporary slotted PVC pipe set at 6.9		8.69 8.99 9.14	SS-7	13 16 15 5 7 15	22	100	12					
	10.5	meters (22.5') 2. Boring backfilled with soil cuttings.												
ENGINE	EERING &	CTL Engineering of Indiana, Inc. 6848 Hillsdale Court Indianapolis, Indiana 46250 Phone: 317-585-8277 Fax: 317-585-8621	BORIN HSA - Hollo SFA - Solid RC - Rock MD - Mud WD - Was HA - Hand	w Stem Flight Coring Drilling h Drillin	Auger Auger J	SS ST CR BS	- She	t Spoo lby Tu k Core Sam	on San ibe Sa e Sam ple	nple * mple L ple P	- Ha L - Liq L - Pla I - Pla	nd Pe uid Li astic L asticity andard	imit Index	neter

			TES	TBC	ORII	NG F	RECC	ORD)							
CLIENT	-		: Indiana Department of Transportation								BOF	RING NO	.:	SSL	3	
PROJE			: Proposed Storm Sewer Line						_		SHE	ET	1	OI	-	1
LOCAT			: SR 15 from 0.56 km S. to 3.10 km N. of L	S 20 in	Elkhar	t Co.					DAT	E STAR	TED	 : 10-2	3-03	
DES NO			: 8354420, Project No.: STP-4320 (3), CTL						_		DAT	E COMP				
BORING			VATION: 262.5 m USC&GS	BORIN			· HSA					MER	***************************************	utoma		
DOKIN			TION : 10+600	RIG TY			: CME 5	5 Truo				LLER	: <u></u> : T			
	_		SET : 20 m Lt						Λ		·					
		INE		CASIN			: <u>83 mm</u>					MPERATI				
			TH : 1.39 m	CORE			·					ATHER		loudy		
GROUN	NDW/	ATE	ER: Lencountered at 3.96 m	At Comp	oletion	<u>1.68 r</u>	 ū ★	24 hou	urs Rea	ding	1.52 n	<u>1</u>		aved ir	ı at <u>2.4</u>	44 m
Stratum Elevation	Sample		SOIL/MATERIAL DESCRIPTION	1		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)		terber Limits	
Str	Sa	3				S S	Sa	R	ŝ	8	ĭŏ	ઽ≷ૹ	ວັບັ	LL	PL	PI
262.42		T	TOPSOIL (75mm) (Visual)	_	₽ŏ́Д	-0.08										
	-		Brown, Moist, Medium Dense, SAND & GRAVEL (FILL) (Visual)				SS-1	10 14 15	29	100						
261.28_	- _1.5_	\bigvee	Brown Changing to Brownish Black, Moist, Medium Stiff, SANDY LOAM with Traces o			_1.22	SS-2	4 4 5	9	33	20					
260.52_	- -	\bigvee	Organics (Possible Fill) (Visual) Brown, Moist, Medium Stiff, SANDY LOAM			_1.98	SS-3	4 3 4	7	100	7					
259.91_	<u>4</u> -		A-4 As Lab 1 Brown, Wet, Very Loose, SAND (Visual)			_2.59		1								
259.60_	3.0_ - - - -		Brown, Wet to Moist, Soft to Stiff, SANDY LOAM A-4 As Lab 2			_2.90	SS-4	3	4	44						
257.93	4.5 <u> </u>	M				4.57	SS-5	8 5	13	100						
201.30	-		Bottom of Boring at 4.57 meters (15.0') Boring backfilled with soil cuttings.					And Andrews or the second of t		- Authorities and Authorities						
	6.0_ _															
			CTL Engineering of Indiana, Inc.			METH			AMPLI				ABBR			
ENGINE	ERING	<u></u>	6848 Hillsdale Court Indianapolis, Indiana 46250 Phone: 317-585-8277 Fax: 317-585-8621	SFA - RC - MD -	Solid Rock Mud [Wash	Orilling Drilling	uger	SS ST CR BS AC	- Split - Shel - Rock - Bag - Auge	by Tul Core Samp	oe Sar Samp le	nple LL ble PL PI	- Liqu Plas - Plas PT - Star	id Pen lid Lim stic Lir sticity l ndard etratic	nit mit Index	

Test Boring Records drilled in 2001 Within the Limits of the Proposed Storm Sewer Line



			Т	EST	BORI	NG F	RECC	ORD								
CLIEN	-	: Indiana	Department of Transportation	1							BOF	RING NO	D.:	RB	3-3	
PROJE	СТ	: SR 15/	US 20 Improvement								SHE	ET	1	0	F	1
LOCAT	ION	: SR 15	from 0.56 km S.of US 20 to 3.	10 km N	l. of US 20						DAT	E STAF	RTED	:_05-1	15-01	
PROJE	CT NO.		320 (7), CTL No.: 00-050061								DAT	E COM	PLETED	: 05-1	15-01	
			: 261.40 USC&GS	ВС	ORING ME	THOD	: HSA				HAN	MER	:_ <u>^</u>	lutom	atic	
	STA	TION	: 10+240		G TYPE		: CME 5	5 Truck			DRII	LLER	: <u> </u>	(0		
			: 10 m Rt : "C"	1	ASING DIA		: 83 mm				TEM	IPERAT	URE : 7	'0° F		
	LINE		: <u>"C"</u> : 2.29 m	$- _{cc}$	ORE SIZE		:				WE	ATHER	: 8	Sunny		
GROUI	NDWAT		Encountered at <u>Dry</u>		Completion			At 24 F	lours	Dry			顧 C	aved i	n at <u>1.</u>	78 m
STRATUM	SAMPLE DEPTH		SOIL/MATERIAL DESCRIP	PTION		STRATUM DEPTH	SAMPLE NUMBER	SPT per 15cm	BLOWS per 30 cm	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, Kg/m³	UNCONF. COMP., kN/m²		TERBE LIMITS	S
ST	용법						δŽ	<u> </u>	mä	% ₹	ΣŎ	2₹	50	LL	PL.	Pl
261.25_ 260.64	<u> </u>	Brown,	IL (152 mm) (Visual) Moist, Loose, SANDY LOAM w of Roots 3	vith		0.15	SS-1	5 5 5	10	89	16			4		
<u></u>	1.5	Brown, Stiff, SA A-4 (0) Lab 1	Slightly Moist, Medium Stiff to NDY CLAY LOAM	Very			SS-2	3 3 4	7	100						
259.11_		Bottom	of Boring at 2.29 meters			2.29	SS-3	6 9 10	19	100	10			18	11	7
	3.0	Boring t	oackfilled with soil cuttings.													Landania de la companyo de la compan
	_															
	4.6															
000000000000000000000000000000000000000	6.1_															The state of the s
<u> </u>	1	CTI	Engineering of Indiana, Ind	c.	BORIN	G MET	HOD	s	AMPL	NG M	ETHO				TIONS	
			E. 75th Street, Suite 176	H	ISA - Holic	w Sten	n Auger	SS			on San		110		netron	neter
	17/		anapolis, Indiana 46250		SFA - Solid RC - Rock	l Flight. c Coring		ST			ıbe Sa e Sam			luid Li astic L		
	EDINOS		ne: 317-585-8277	M	1D - Mud	Drilling		BS	- Bag	Sam	ple	' F	Pl - Pla	asticity	/ Index	:
ENGINA	.criing z			1	VD - Was	h Drillin	g	AC	- Aug	er Cu	ttings	1	SPT - Sta		d ion Te	st
<u> </u>		Fax:	317-585-8621	<u> </u>	IA - Han	d Auger						i_	re	neual	.011 16	J

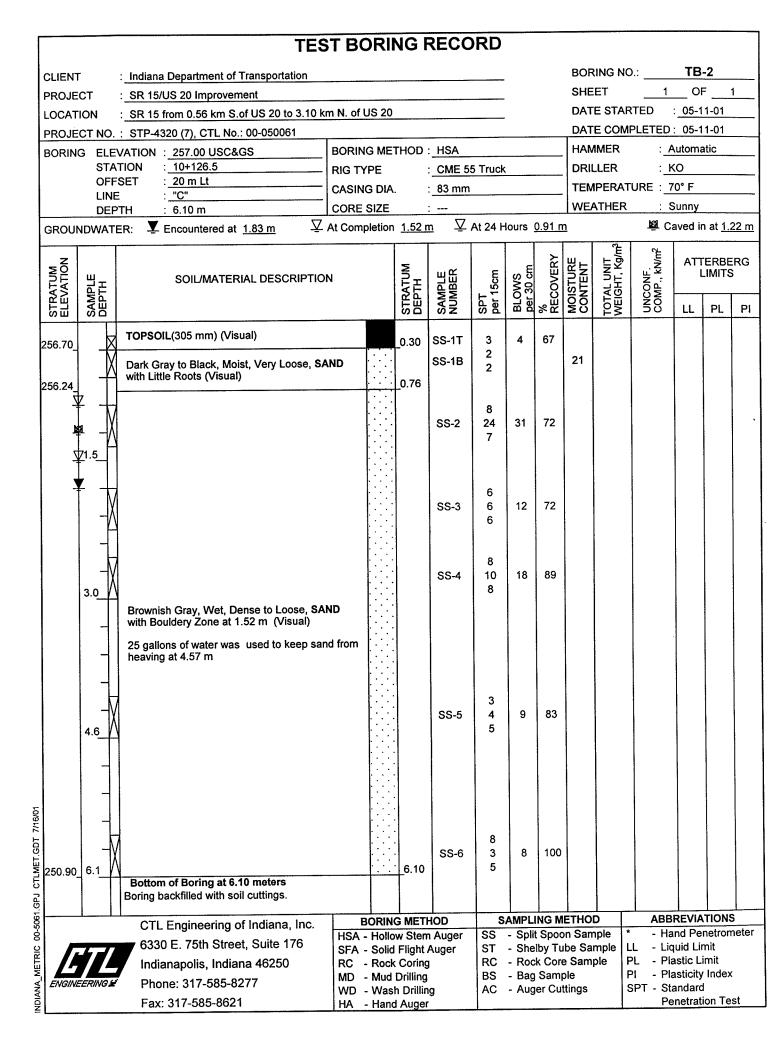
				TES	TBO	ORI	NG I	RECC	ORD								
CLIEN	Т	: Indian	a Department of Transport	ation								BOF	RING N	O.:	RB	-4	
PROJE			/US 20 Improvement									SHE	ET	1	OF	=	1
LOCAT			from 0.56 km S.of US 20	to 3.10 kr	n N. of	US 20)					DAT	E STA	RTED	: 06-2	0-01	
			320 (7), CTL No.: 00-0500							•		DAT	E CON	IPLETED	: 06-2	0-01	
			: 265.00 USC&GS		BORIN	IG ME	THOD	: HSA				HAN	MER	: /	Automa	atic	
		TION	: 10+360		RIG TY			: CME 5	50 ATV	,		DRII	LLER	: H	(0		
		SET	: 10 m Rt : "C"		CASIN	G DI		: 83 mm				TEN	1PERA	TURE : 8	80° F		
	LINE		: 3.05 m		CORE	SIZE		:				1	ATHER	_	Sunny		
GROU	NDWAT		Encountered at 0.91 m	∇			n <u>2.51</u> ı	m ∇	At 24 F	lours	0.91 r	n		18 C	aved ir	at 1.0	68 m
						•	1		T	T		_ 	ஓ		· · · · · ·		
STRATUM	SAMPLE DEPTH		SOIL/MATERIAL DESC	CRIPTION	٧		STRATUM DEPTH	SAMPLE NUMBER	SPT per 15cm	BLOWS per 30 cm	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, Kg/m³	UNCONF. COMP., KN/m²		ERBE IMITS PL	
ош 264.85	<u>ν</u> Δ	GRAVE	EL (Fill) (152 mm) (Visual)			ह्रू		0,2	0, 6		% Ц	20	<u> F</u> S	1-30	LL	PL_	PI
204.00_			Moist, Loose, SANDY LOA!	VI		ĦĤ	10.13		7								
		A-4 As Lab				$ \cdot \cdot $		SS-1	5 2	7	433	15					
264.39_	1 +	AS Lab	3				· [0.61		-								
<u>.</u>	1.5	Brown to Stiff, A-4 As Lab	with Gray Streaks, Moist, N	Medium S	itiff			SS-2	2 2 5	7	522	18					
262.71_		As Lab	1				2.29	SS-3	4 6 9	15	556						
261.95	¥ -	Brown, A-4 As Lab	Slightly Moist, Stiff, LOAN 5	1			3.05	SS-4	4 5 7	12	556				Maria de la companya		
261.95	3.0		of Boring at 3.05 meters				3.03										
			backfilled with soil cuttings The 24-hours groundwate														
		may be	e due to rain accumulated i	in the bor	ehole.												
	4.6																
								ļ									
5																	
50]				
G5.	-																
I I	6.1_																
						<u> </u>		<u> </u>	ļ		<u> </u>			1		<u></u>	<u>L.</u>
20-00		CTL	. Engineering of Indiana	, Inc.			G METI					ETHOI n Sam			REVIA nd Per		
	7	633	0 E. 75th Street, Suite 1	176	1		ow Sterr I Flight	-	ST	- She	lby Tu	be Sai	mple		uid Lin		.0.01
		India	anapolis, Indiana 46250)	RC -	- Rocl	k Coring	l	RC	- Roc	k Core	Sam	ole		stic Li		
ENGINE	ERING	Pho	ne: 317-585-8277				Drilling h Drillin			- Bag - Aug				PI - Pla SPT - Sta	sticity andard	index	
		Fax	: 317-585-8621				d Auger			9	ou!				netrati	on Te	st

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				TES	T BC	RI	NG	RECO	DRD								
CLIEN	Γ	:_Indiana	a Department of Trans	sportation								BOF	RING NO	O.:	RB	-5	
PROJE			US 20 Improvement									SHE	EΤ	1	0	F	1
LOCAT	ION	: SR 15	from 0.56 km S.of US	S 20 to 3.10 km	n N. of L	JS 20)					DAT	E STAF	RTED	:_05-1	5-01	
PROJE			320 (7), CTL No.: 00-									DAT	E COM	PLETED	: 05-1	5-01	
			: 264.50 USC&GS		BORING	G ME	THOD	: HSA				HAN	MER	:_ <i>F</i>	Automa	atic	
	STA	TION	: 10+480		RIG TY			: CME 5	55 Truck			DRII	LLER	: <u> </u>	(0		
	OFF LINE		: 5 m Rt : "C"		CASING	G DIA	۸.	: 83 mm	1			TEN	IPERAT	TURE : 7	′5° F		
	DEP		: 3.05 m		CORE	SIZE		;				WE	ATHER	: 8	Sunny		
GROUI	NDWATI		Encountered at Dry	∑,	At Comp	letio	n <u>Dry</u>	⊽	At 24 H	lours	Dry				aved i	n at <u>2.2</u>	29 m
STRATUM	SAMPLE DEPTH		SOIL/MATERIAL I	DESCRIPTION	1		STRATUM DEPTH	SAMPLE NUMBER	SPT per 15cm	BLOWS per 30 cm	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, Kg/m³	UNCONF. COMP., KN/m²		ERBE IMITS	
264.14_	_ 	Gray ch	LT CONCRETE (356 nanging to Brown, Slig n Dense, SANDY LOA	htly Moist,		**	0.36	:	6								
263.59_		A-4 As Lab					0.91	SS-1	8 5	13	100	13					
	-V 1.5V					***************************************		SS-2	3 6 10	16	72	11					•
<u> </u>		Brown v Stiff, LO A-4 As Lab	with Gravel Streaks, S DAM (TILL) 5	Slightly Moist, '	Very			SS-3	4 7 10	17	100					A PARTY PART	
261.45_	3.0	Bottom	of Boring at 3.05 me	oters			3.05	SS-4	3 7 9	16	100						
			backfilled with soil cuent restored with cond														
	4.6																
10/91/																	
2																	
UC-SUCTIONET COLD (710/01)	6.1																
<u>5</u>		L			n	OPIN	IG MET	HOD	-	AMPLI	NG M	 ETHO		ΔRR	 REVIA	TIONS	<u></u>
,			Engineering of Inc					n Auger	SS			n San				netrom	
			DE. 75th Street, Su		SFA -	Solid	l Flight	Auger	ST	- She	lby Tu	be Sa	mple l		uid Li		
		/	anapolis, Indiana 4	6250			k Coring Drilling		RC BS	- Roc - Bag					astic Li asticity	Index	
ENGINE ENGINE	EERING H		ne: 317-585-8277		WD -	Was	h Drilli	ng	AC	- Aug				SPT - Sta	andard	i	
2		Fax:	317-585-8621		HA -	Han	d Auge	ſ						Pe	netrat	on Tes	st

			TES	ST BO	ORI	NG F	RECC	RD								
CLIENT	-	:_Indiana	a Department of Transportation								BOR	RING N	0.:	ТВ	-1	
PROJE			/US 20 Improvement								SHE	ET	1	OF	=	1
LOCAT		: SR 15	from 0.56 km S.of US 20 to 3.10 k	m N. of	US 20						DAT	E STAI	RTED	: 05-2	2-01	
PROJE	CT NO		320 (7), CTL No.: 00-050061								DAT	E COM	IPLETED	: 05-2	2-01	
			: 257.65 USC&GS	BORIN	IG ME	THOD	HSA				HAN	MER	:_ _	utoma	atic	
		ATION	: 10+128	RIG TY	/PE		CME 5	5 Truck			DRII	LLER	: <u> </u>	(0		
		FSET	: 20 m Rt : "C"	CASIN	G DIA	•	83 mm				TEM	IPERA	TURE : _7	′5° F		
	LIN	ie PTH	: 4.57 m	CORE	SIZE						WE	ATHER	: 8	Sunny		
GROUI				At Com		1.83 r	n Z	At 24 F	lours	1.83 r	<u>n</u>		≅ C	aved ir	1 at <u>3.</u>	<u>58 m</u>
STRATUM	SAMPLE DEPTH		SOIL/MATERIAL DESCRIPTIO	'n		STRATUM DEPTH	SAMPLE	SPT per 15cm	BLOWS per 30 cm	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, Kg/m³	UNCONF. COMP., KN/m²		ERBE IMITS	
257.19_		торѕо	DIL(457 mm) (Visual)			0.46										
			o Dark Gray, Moist, Very Loose, / LOAM				SS-1 SS-2	2 2 1 0 1	3	94 67	28					
256.13_ <u>\</u>	1.5	Black to A-1-b As Lab	o Dark Gray, Moist, Loose, SAND			1.52	SS-3	4 5 4	9	67					The state of the s	
	3.0	Browni (Visual	ish Gray, Wet, Medium Dense, SA ll)	ND			SS-4	4 5 6	11	67						and the second s
253.08	4.6_	Botton	n of Boring at 4.57 meters	Market and the second		4.57	SS-5	5 8 13	21	89						
10017			backfilled with soil cuttings. used to pull drilling rig.													
GP3 C1EMET O	6.1															
C.S. Constitution	1	CTI	_ Engineering of Indiana, Inc.	E	BORIN	G MET	IOD	S			ETHO			REVIA		
<u> </u>			30 E. 75th Street, Suite 176				Auger	SS			on San			ind Pe juid Lir		neter
	41		ianapolis, Indiana 46250			l Flight. Coring		RC			ıbe Sa e Sam			astic Li		
E FNRIM	EERING		one: 317-585-8277	MD	- Mud	Drilling		BS	- Bag	Sam	ple			asticity		(
Z - 7.011/1			(: 317-585-8621			h Drillin d Auger		AC	- Aug	er Cu	ttings		SPT - St	andard enetrati		est

Special control of



APPENDIX C

LABORATORY TEST RESULTS

Summary of Classification Test Results Grain Size Distribution Curves Unconfined Compression Test Results Summary of Special Laboratory Test Results



				_
CBR (0)	97%			
(BR)	93%			
Max. Dry Optimum CBR CBR WC LL PL Pl Density Content	(%)			
Aax. Dry Density	(bct)			
		5	5	
П		12	12	
		22	22	
<u></u> ≪C		13	7	
ution	Clay	15.7	17.5	
istrib	Sii	26.4	28.	
Percent Passing Grain Size Distribution (Sieve No.)	10 40 200 Gravel Sand Silt Clay	49.4	46.9	
Grain	Gravel	8.5	7.5	
ssing o.)	200	42.1	45.6	
nt Pas ve No	40	73.3	76.0	
Percent Passir (Sieve No.)	10	91.5	92.5	
С	dnoio	LOAM A-4 (1) 91.5 73.3 42.1 8.5 49.4 26.4 15.7 13 22 12 10	LOAM A-4 (1) 92.5 76.0 45.6 7.5 46.9 28.1 17.5 11 22 12 10	
Soil	Classification	SANDY LOAM	SANDY LOAM	
Depth		ab 1 SSL-1 10+293 15 m Lt "B" SS-1 0.30-0.76 SANDY	Lab 2 SSL-1 10+293 15 m Lt "B" SS-3 1.83-2.29 SANDY I	
Sample	ė Š	SS-1	SS-3	
ine	}	"B"	"B"	
Offset Line Sample		15 m Lt	15 m Lt	
Lab Boring Station		10+293	10+293	
Boring	o N	SSL-1	SSL-1	
Lab	Š.	Lab 1	Lab 2	

SUMMARY OF CLASSIFICATION TEST RESULTS

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Project No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



SUM_CLASS-METRIC 00-61.GPJ CTLMET.GDT 2/4/04

0000150	OD 43 /51	SA	ND	SILT	CLAY	
COBBLES	GRAVEL	coarse	fine	OIL I	CLA	

GRAIN SIZE IN MILLIMETERS

Boring No.	SSL-1		(Classificati	on		MC	LL	. PL	PI	Сс	Cu
Sample	SS-1		S	ANDY LO	AM		13	22	12	10		
Depth	0.30-0.76			A-4(1)								
Station	10+293			Lab 1								
Offset	15 m Lt											
Line	"B"											
Remarks		D100	D60	D50	D30	D10	%Gra	vel	%Sand	%Si	lt 9	%Clay
		9.5	0.202	0.116	0.017	i	8.5	,	49.4	26.4		15.7



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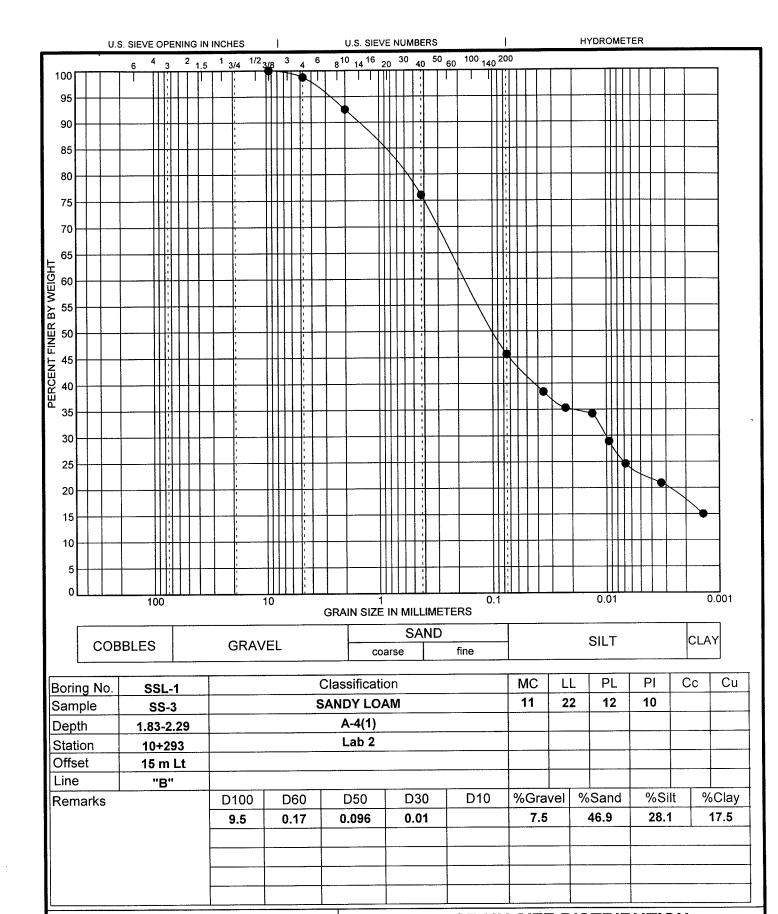
Fax: 317-585-8621 e-mail: ctlin@ctleng.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061





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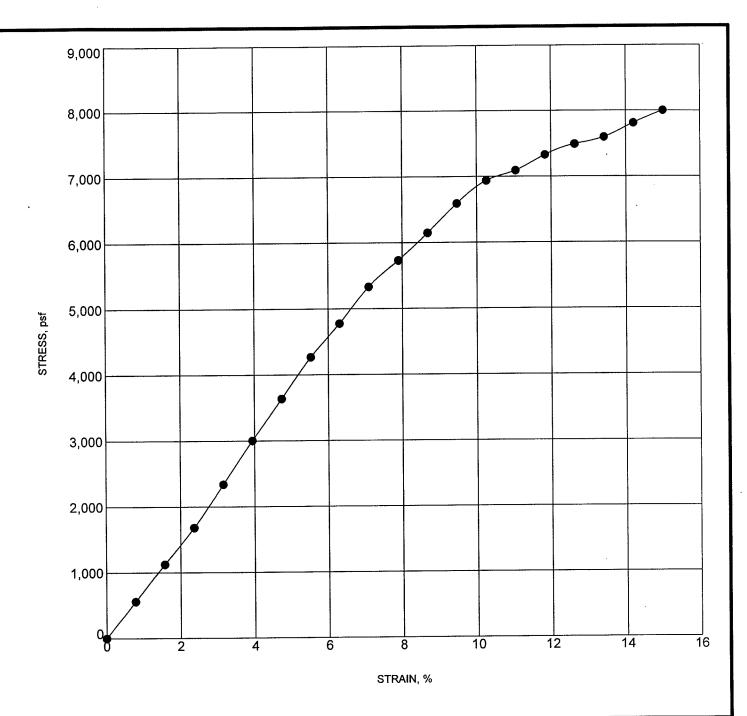
Phone: 317-585-8277
Fax: 317-585-8621
e-mail: ctlin@ctleng.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



Boring Inform	nation	Test Results	English	Metric
Boring No.	SSL-1	Natural Moisture Content, %	11	11
Sample	SS-4	Natural Wet Density, pcf (kg/m³)	139.4	(2235)
Depth	2.59 - 3.05	Natural Dry Density, pcf (kg/m³)	125.3	(2008)
Station	10+293	Unconfined Compression Strength, psf (kN/m²)	8003	(383)
Offset	15 m Lt	Failure Strain, %	15.0	15.0
Line	"B"	SOIL DESCRIPTION		



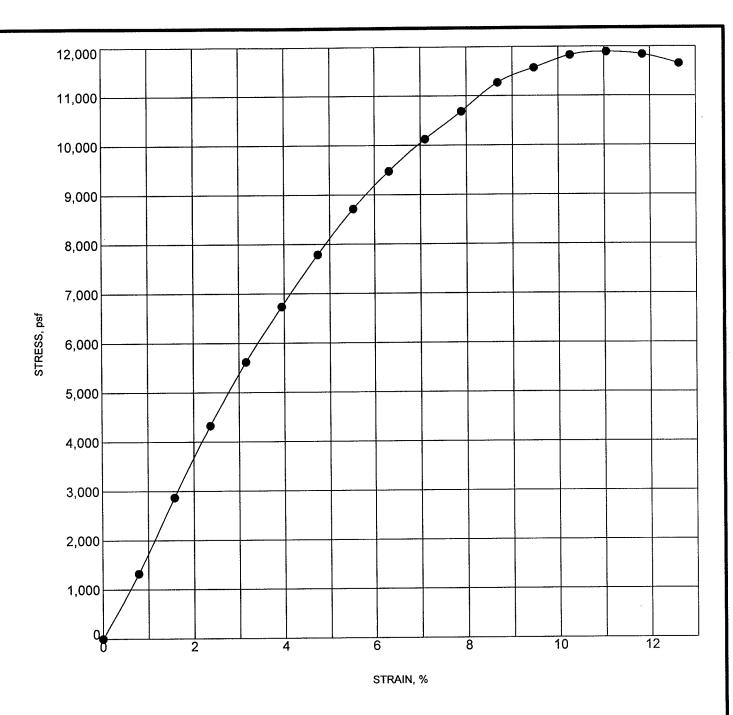
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Phone: 317-585-8277 Fax: 317-585-8621 e-mail: ctlin@ctleng.com

UNCONFINED COMPRESSION TEST

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co. Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



Boring Information		Test Results	English	Metric
Boring No. SSL-2		Natural Moisture Content, %	11	11
Sample	SS-2	Natural Wet Density, pcf (kg/m³)	132.3	(2120)
Depth	1.07 - 1.53	Natural Dry Density, pcf (kg/m³)	118.8	(1904)
Station	10+473	Unconfined Compression Strength, psf (kN/m²)	11893	(569)
Offset	15 m Lt	Failure Strain, %	11.1	11.1
Line	"B"	SOIL DESCRIPTION		



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UNCONFINED COMPRESSION TEST

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co. Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

Sheet 1 of 1

Boring No.	Station	Offset	Line	Sample No.	Depth (m)	Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Unconfined Compression (psf)	Failure Strain (%)	Loss on Ignition (%)	pН
SSL-1	10+293	15 m Lt	"B"	SS-1	0.30-0.76	13						8.34
SSL-1	10+293	15 m Lt	"B"	SS-3	1.83-2.29	11						8.39
SSL-1	10+293	15 m Lt	"B"	SS-4	2.59-3.05	11	139.4	125.3	8003	15.0		
SSL-1	10+293	15 m Lt	"B"	SS-5	4.11-4.57	12						
SSL-1	10+293	15 m Lt	"B"	SS-6	5.03-5.49	22						•
SSL-2	10+473	15 m Lt	"B"	SS-1	0.30-0.76	11						•
SSL-2	10+473	15 m Lt	"B"	SS-2	1.07-1.52	11	132.3	118.8	11893	11.1		
SSL-2	10+473	15 m Lt	"B"	SS-4	2.59-3.05	12						
SSL-2	10+473	15 m Lt	"B"	SS-6	5.64-6.10	19						
SSL-2	10+473	15 m Lt	"B"	SS-8	8.69-9.14	12						
SSL-3	10+600	20 m Lt	"B"	SS-2	1.07-1.52	20						
SSL-3	10+600	20 m Lt	"B"	SS-3	1.83-2.29	7						
TB-2	10+126.5	20m Lt	"C"	SS-1B	0.30-0.61	21					1	



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e-mail: ctlin@ctleng.com

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co. Project No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

APPENDIX D GENERALIZED SOIL PROFILE



IN_PROFILE_MET 00-61.GPJ CTLMET.GDT 2/3/04

CTL Engineering of Indiana, Inc.

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e-mail: ctlin@ctleng.com

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Established 1927

August 17, 2001

Indiana Department of Transportation Materials and Tests Division 120 South Shortridge Road Indianapolis, Indiana 46219

Attention:

Mr. Athar Khan, P.E.

Chief Geotechnical Engineer

Reference:

Subsurface Investigation

Des. No.: 8354420

Project No.: STP-4320 (7)

SR 15 from 0.56 km S. of US 20 to a point 3.10 km N. of US 20

Elkhart County

CTL Project No. 00-050061

Dear Mr. Khan:

CTL engineering has completed the subsurface investigation on the above referenced project. Enclosed are ten (10) copies of the report.

Thank you for giving us the opportunity to assist on this project. If you have any questions, please call me at 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

Ali Karaki

SUBSURFACE INVESTIGATION

DES. NO.: 8354420
PROJECT NO.: STP-4320 (7)
SR 15 FROM 0.56 KM S. OF US 20 TO A POINT 3.10 KM N. OF US 20
ELKHART COUNTY
CTL PROJECT NO. 00-050061

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION MATERIALS AND TESTS DIVISION 120 SOUTH SHORTRIDGE ROAD INDIANAPOLIS, INDIANA 46219

PREPARED BY:

CTL ENGINEERING OF INDIANA, INC. 6330 EAST 75TH STREET, SUITE 176 INDIANAPOLIS, INDIANA 46250

> JULY 19, 2001 Revised August 15, 2001



SUMMARY OF SUBSURFACE INVESTIGATION

The project site is located on State Route 15 from 0.56 km south of US 20 to a point 3.10 km north of US 20, in Elkhart County, Indiana. The project involves roadway improvement on SR 15, US 20, CR 14 and CR 112 for a total roadway length of 5267.00 meters.

- On SR 15, the proposed improvement involves roadway relocation, widening and/or full depth pavement replacement. The new roadway profile will be constructed near the existing grade, on newly placed fill or in cut areas with maximum cut and fill of ±31 feet (9.5 m) and ±26 feet (8 m), respectively. A precast concrete box culvert will be constructed at Station 10+122, along with a number of pipe culverts.
- On US 20, CR 14 and CR 112 and Line "H", the proposed improvement involves roadway widening and full depth pavement replacement. The new roadway profile will be constructed near the existing grade, on newly placed fill or in cut areas.

A subsurface investigation for the subject project has been completed, and a summary of our findings and recommendations is reported below. Detailed foundation recommendations and construction considerations are provided in the enclosed report.

BOX CULVERT

- 1. The box culvert at Station 10+122 may be placed on existing soils provided that all loose sand are densified with a vibratory roller or removed and replaced with "B" Borrow or No. 53 aggregate to a minimum depth of 24 inches (600 mm)
- 2. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment.
- 3. The culvert wingwalls may be supported on conventional foundation systems constructed on the sand deposits. The foundation units may be proportioned using the allowable soil bearing capacities and the estimated soil parameters shown in Table 1 and 2 of this report.
- 4. The wingwall footings should be constructed at a minimum depth of 4 feet (1.2 m) below the lowest flow line elevation. The recommended depths of footings do not account for any scour. If scour is of concern, the bottom of footings should be constructed below the anticipated scour elevation and/or as recommended by INDOT Hydraulics Division.
- 5. Borrow type and placement, and drainage structure installations should conform to INDOT specifications.



Summary of Subsurface Investigation SR 15/US 20 Improvement, STP-4320 (3) July 19, 2001, Revised August 15, 2001 Page 2

DRAINAGE PIPE STRUCTURES

Borrow type and placement, and drainage structure installations of major and minor pipe culverts should conform to INDOT specifications.

ROADWAY

1. Pavement Considerations

- a. In fill areas, it is recommended that the proposed pavement including shoulders be constructed over 24 inches (600 mm) of subgrade treatment.
- b. In cut areas, at grade and in cut to fill transition, one of the following alternatives may be used.
 - Alternative 1: An in-place chemical soil modification 16 inches (400 mm) in thickness following INDOT Standard Specifications Section 215.
 - Alternative 2: Undercut and replace with a layer of 12 inches (300 mm) of No. 53 aggregate.
 - Alternative 3: Where granular soils of A-1, A-2 or A-3 exist, a 24-inch (600 mm) of subgrade treatment may be used.
- c. The proposed pavement may be designed using an estimated CBR value of 2.7 based on engineering judgement and data bank from INDOT.
- d. Pavement subsurface drains with screened outlets should be installed in areas where the subgrade soils are cohesive (sandy clay loam or loam), and in areas where cohesive soils are placed in the upper 3 feet of the embankments. However, the subsurface drains may be omitted in sections where the subgrade soil consists of sand. If the proposed borrow is similar to the soils encountered on this project, filter fabric for the subsurface drains may not be required.
- e. Interceptor drains should be installed in areas of cut to fill transition.



Summary of Subsurface Investigation SR 15/US 20 Improvement, STP-4320 (3) July 19, 2001, Revised August 15, 2001 Page 3

2. Embankments

- a. Backfill materials required for embankment construction should be placed and compacted according to INDOT Standard Specifications.
- b. Embankment side slopes, in cut or fill, constructed at a rate no steeper than 3:1 (horizontal to vertical) are considered safe against sliding and slope failure. Exposed slopes consisting of sandy soils should be encased with a minimum of 12 inches (300 mm) of topsoil.
- c. New embankments constructed on or adjacent to existing natural slopes or existing embankments should be benched according to INDOT Standard Specifications.
- d. It is estimated that total settlement under maximum embankment fill is on the order of 5.9 inches (300 mm). Therefore, settlement plates should be installed at 100 ft. (30 m) c/c staggered intervals from Station 11+730 to Station 11+850, line "C" and from Station 12+700 to Station 12+790, line "C" and monitored per INDOT requirements.
- e. Drainage ditches sloping at a rate of 3 percent or greater should be seeded and/or protected with riprap or other erosion protection.
- f. Temporary excavation more than 4 feet (1.2 m) in depth should be sloped and/or shored according to OSHA requirements.
- g. Groundwater may be encountered at or above the proposed subgrade elevations in cut areas depending upon time of construction and amount of precipitation. The side ditches proposed in these locations are considered adequate to maintain the subgrade in a relatively dry condition.

Please refer to the enclosed Geotechnical report for additional information.



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Subsurface Investigation SR 15/US 20 Improvement

Project No.: STP-4320 (3), CTL No. 00-050061

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I. PROJECT LOCATION AND DESCRIPTION

The project site is located on State Route 15 from 0.56 km south of US 20 to a point 3.10 km north of US 20, in Elkhart County, Indiana. The project involves roadway improvement on SR 15, US 20, CR 14 and CR 112 as summarized below.

• On SR 15, the proposed improvement involves roadway relocation, widening and/or full depth pavement replacement between Stations 9+850 and 13+570, Line "C", for approximately 3,720 meters. The new roadway profile will be constructed near the existing grade, on newly placed fill or in cut areas. Embankments and drainage ditches will be constructed with maximum cut and fill of ±31 feet (9.5 m) and ±26 feet (8 m), respectively.

Additionally, a box culvert 3600mm x 1800mm x 57m will be constructed at Station 10+122, with invert elevations ranging between 256.40 at upstream and 256.20 at downstream. Also, a pipe culvert 48.5-m long by 1200 mm in diameter will be constructed at Station 12+63, with invert elevations ranging between 256.56 at upstream and 255.25 at downstream. The flow line of this culvert ranges between 248.620 at upstream and 248.478 at downstream. Additionally, a number of minor culverts of 900 mm or smaller will be constructed along the proposed roadway.

- On US 20, the proposed improvement involves roadway widening and full depth pavement replacement between Stations 4+974 and 5+821, Line "S-ÚS20-B", for approximately 847 meters. The new roadway profile will be constructed near the existing grade, on newly placed fill or in cut areas. Embankments and drainage ditches will be constructed with maximum cut and fill of ±1.5 feet to ±3 feet.
- On CR 14, the proposed improvement involves roadway widening and full depth pavement replacement between Stations 4+945.224 and 5+080.00 Line "S-1-B", and between Station 5+065.000 and 5+190.532 Line "S-3-B", for approximately 260 meters. The new roadway profile will be constructed near the existing grade, on newly placed fill or in cut areas. Embankments and drainage ditches will be constructed with maximum cut and fill of ±10 feet to ±3 feet, respectively.
- On CR 112, the proposed improvement involves roadway widening and full depth pavement replacement between Stations 4+945.224 and 5+185, Line "S-2-B", for approximately 240 meters. The new roadway profile will be constructed in cut areas or near the existing grade. The proposed profile will be constructed with maximum cut of ±20 feet (6.2 m).



Subsurface Investigation SR 15/US 20 Improvement

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• On Line "H", the proposed improvement involves full depth pavement replacement between Stations 1+004.367 and 1+203.00 for approximately 200 meters. The new roadway profile will be constructed in cut areas or near the existing grade. The proposed profile will be constructed with maximum cut of ± 15 feet (4.5 m).

II. SUBSURFACE INVESTIGATION

Forty (40) soil test borings, designated as RB-1 through RB-40, were drilled along the roadway profile to depths ranging from 7.5 to 45.0 feet (2.29 m to 13.72 m). Additionally, two (2) borings, designated as TB-1 and TB-2, were drilled for the proposed box culvert, and one (1) boring, designated as TB-3, was drilled for the proposed pipe culvert. These borings were extended to depths ranging from 15 to 20 feet (4.57 m to 6.10 m). Locations of the test borings are shown on the attached test boring records.

The test borings were advanced with a truck or an ATV mounted drilling rig utilizing hollow stem augers (HSA) on May 9 through June 21, 2001. Standard Penetration tests were conducted using a 140- pound hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches.

Drilling, soil sampling and laboratory testing have been performed following standard geotechnical engineering practices, INDOT and current ASTM procedures. Results from field tests are shown on the enclosed boring records.

Soil samples obtained from the drilling operation were preserved in glass jars and visually classified in the field and laboratory. Representative soil samples were tested for natural moisture content, Atterberg Limits, grain size analysis, unconfined compression and pH.

Soil bag samples were obtained at boring RB-7 at a depth of 0.5 to 3.0 feet beneath the existing grade. The recovered soils were tested for grain size analysis, Atterberg limits, moisture density relation (Modified Proctor) and California Bearing Ratio (CBR).

The stations, offsets and surface elevations of the test borings were interpolated from the site plans provided by INDOT.



Subsurface Investigation SR 15/US 20 Improvement Project No.: STP-4320 (3), CTL No. 00-050061 July 19, 2001, Revised August 15, 2001 Page 3

III. <u>FINDINGS</u>

Test borings RB-1, RB-5, RB-14, RB-23, RB-24, RB-25, RB-28 through RB-31, drilled within the pavement limits of SR 15, exhibited 5 to 36 inches (127 to 914 mm) of asphalt concrete, averaging approximately 13.75 inches (351 mm) in thickness. RB-2, RB-18, RB-19 and RB-20 exhibited 3 to 6 inches (76 to 152 mm) of asphalt concrete over 5 to 19 inches (127 to 483 mm) of Portland cement concrete. A layer of asphalt concrete, 3 inches (76 mm) in thickness was encountered beneath the Portland cement concrete in RB-20. RB-4 drilled outside the pavement limits of SR 15 exhibited 6 inches (152 mm) of gravel base at the surface. RB-6, RB-7 and RB-40 were bare at the surface due to construction activities that took place prior to drilling operation. Similarly, RB-8 and RB-22 were bare at the surface due to using a dozer prior to drilling. The remaining borings drilled along SR 15 exhibited topsoil averaging approximately 6 inches (152 mm) in thickness.

Test borings RB-32, RB-33 and RB-36, drilled on US 20, exhibited 2 to 3 inches (51 to 76 mm) of asphalt concrete pavement over 4 to 12 inches (102 to 305 mm) of Portland cement concrete. A layer of asphalt concrete, 2 inches (51 mm) in thickness was encountered beneath the cement concrete in RB-36. Beneath the pavement, RB-32 and RB-36 exhibited a layer of base course 4 and 8 inches in thickness, respectively. RB-34 and RB-35, drilled outside the existing pavement limits of US 20, exhibited gravel base or sand fill.

Test borings RB-37, RB-38 and RB-39, drilled on CR 14 and CR 112, exhibited 4 to 7 inches (127 to 178 mm) of asphalt concrete pavement over 3 to 6 inches (76 to 152 mm) of base course.

Beneath the pavement or topsoil, the test borings encountered clay, sandy clay loam, loam sandy, loam, and/or sand of A-6, A-4 and A-1-b soil categories. Standard penetration blowcount values in the soil overburden ranged from 0 to 37 blows per foot (bpf), with natural moisture content values ranging from 5 to 34 percent.

Standard moisture density tests indicated that the clay soils from boring RB-7 may attain a maximum dry density of 118.2 pcf (1890 kg/m³) at 13.7 percent optimum moisture content.

The pH of representative soil samples ranged from 7.94 to 8.87.

Groundwater was encountered in the test borings as shown on the enclosed test boring records.



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IV. ANALYSIS AND RECOMMENDATIONS

A. BOX CULVERT (3600mm x 1800mm (12' x 6')

- 1. The box culvert at Station 10+122 may be placed on existing soils provided that all loose sand are densified with a vibratory roller or removed and replaced with "B" Borrow or No. 53 aggregate to a minimum depth of 24 inches (600 mm)
- 2. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment.
- 3. The culvert wingwalls may be supported on conventional foundation systems constructed on the sand deposits. The foundation units may be proportioned using the allowable soil bearing capacity shown in Table 1, and the estimated soil parameters shown in Table 2.

Table 1 - Allowable Bearing Capacity vs. Footing Width

Proposed Fo	ooting Width	Allowable Bearing Capacity		
Feet	Meters	psf	kPa	
2	0.6	1500	70	
3	0.9	1700	80	
4	1.2	1800	90	
5	1.5	2000	100	

Table 2 - Soil Parameters

Soil Parameters	Estimated Value		
Allowable Soil Bearing Pressure, psf (kPa)	See Table 1		
Angle of Internal Friction of Foundation Soil (φ), degrees	30		
Friction Factor (f) of Foundation Soil	0.58		
Ultimate Cohesion of Foundation Soil (C), psf (kPa)	0		
Ultimate Adhesion between Footings and Foundation Soil (C ₃), psf (kPa)	0		
Friction Angle Between Wingwall and Backfill Material, degrees	18		



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July 19, 2001, Revised August 15, 2001

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- 4. The wingwall footings should be constructed at a minimum depth of 4 feet (1.2 m) below the flow line elevation to offset the effects of frost penetration. The recommended depths of footings do not account for any scour. If scour is of concern, the bottom of footings should be constructed below the anticipated scour elevation and/or as recommended by INDOT Hydraulics Division.
- 5. Borrow type and placement, and drainage structure installations should conform to INDOT specifications along with the following recommendations.
 - Where hand compactors are used, the backfill should be placed in layers not exceeding 6 inches (150 mm) in loose thickness. When larger compaction equipment is used, it should run parallel to the axis of the structure starting at the outside edge of the excavation and progressing toward the structure.
 - When the level of fill reaches the top of the structure, two lifts should be carefully spread and hand compacted over the structure without traversing the structure with heavy equipment. Compaction with heavy equipment should not begin until a minimum of two lifts have been placed, hand compacted, and tested. The compaction equipment should traverse the drainage structure perpendicular to the axis in accordance with the culvert manufacturer recommendations.
 - Riprap and a permeable filter fabric should be used at the ends of the structure to protect the exposed structure backfill above the existing ground.
- 6. Groundwater, surface water and/or seepage water is anticipated during placement of the culverts. A dewatering system as determined by the contractor and approved by the engineer will be required to maintain the exposed surface in a working condition.
- 7. The pH values obtained from the laboratory testing indicate that the in-situ soils have minor to no corrosion effect on the proposed culverts.
- 8. Temporary excavations in excess of 1.2 m (4.0 feet) in depth should be sloped or shored according to OSHA requirements.
- 9. Removal of existing structures and wingwalls, and existing pavement should be performed according to INDOT Specifications.



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B. <u>DRAINAGE PIPE STRUCTURES</u>

Borrow type and placement, and drainage structure installations of major and minor pipe culverts should conform to INDOT specifications.

C. ROADWAY

Based upon the roadway plans, visual observation and the soil data obtained from the field and laboratory testing, the following conclusions are made.

- The proposed pavement along SR 15, US 20, CR 14 and CR112 will be constructed at or near the existing grade, on newly placed fill of 3 feet to 26.25 feet in height, and/or in cut areas up to 31 feet in height.
- The predominant soils at the proposed subgrade are described as sandy clay loam, loam or sand.
- A CBR test was performed on soil samples obtained from RB-7, and the test results are attached in Appendix C.

Based upon the above conclusions, pavement considerations, embankment and site preparation recommendations are provided in the following paragraphs.

1. Payement Considerations

- a. In fill areas, it is recommended that the proposed pavement including shoulders be constructed over 24 inches (600 mm) of subgrade treatment.
- b. In cut areas, at grade and in cut to fill transition, one of the following alternatives may be used.
 - Alternative 1: An in-place chemical soil modification 16 inches (400 mm) in thickness following INDOT Standard Specifications Section 215.
 - Alternative 2: Undercut and replace with a layer of 12 inches (300 mm) of No. 53 aggregate.
 - Alternative 3: Where granular soils of A-1, A-2 or A-3 exist, a 24-inch (600 mm) of subgrade treatment may be used.



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- c. Based on the judgement and data bank from INDOT, we recommend that the proposed pavement may be designed using an estimated CBR value of 2.7.
- d. Pavement subsurface drains with screened outlets should be installed in areas where the subgrade soils are cohesive (sandy clay loam or loam), and in areas where cohesive soils are placed in the upper 3 feet of the embankments. However, the subsurface drains may be omitted in sections where the subgrade soil consists of sand. If the proposed borrow is similar to the soils encountered on this project, filter fabric for the subsurface drains may not be needed.
- e. Interceptor drains should be installed in areas of cut to fill transition such as at stations 10+300, 1+500, 10+640, 1+980, 11+00, etc.

2. Embankments

a. In Fill Areas

- Backfill materials required for embankment construction should be placed and compacted according to INDOT Standard Specifications.
- Embankments constructed on or adjacent to existing natural slopes or existing embankments should be benched according to INDOT Standard Specifications.
- Embankment side slopes constructed at a rate no steeper than 3:1 (Horizontal to Vertical) are considered safe against sliding and slope failure.
- Settlement of the new roadway embankments may vary with height and type of the proposed fill, and type of underlying soils. Settlement analysis at Station 12+760 where the proposed embankment height is ±20.8 feet (6.3 m) indicated that a total settlement of 5.9 inches (150 mm) may take placed under the new fill. To limit amount of future settlement of the pavement, we recommend that settlement plates be installed and monitored in areas where the fill height is 15 feet to 20 feet.



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settlement plates should be installed at 100 ft. [30 m] c/c staggered intervals from Station 11+730 to Station 11+850, line "C" and from Station 12+700 to Station 12+790, line "C". Installation and monitoring of the settlement plates should follow INDOT requirements. A waiting period of up to 10 weeks may be needed prior to placement of any pavement structure. However, the settlement readings should not exceed 0.1 foot (3 mm) for four (4) consecutive weeks per INDOT specifications.

b. In cut areas

Slope stability analysis was performed at Station 11+080 where the new embankment will be constructed in cut of ± 33 feet (10 m) in height. This analysis indicated that embankment side slopes constructed at a rate no steeper than 3:1 (horizontal to vertical) are considered safe against sliding and slope failure.

- c. In fill and cut areas, exposed slopes consisting of sandy soils should be encased with a min8mum of 12 inches (300 mm) of soils suitable for vegetation growth. Also, the exposed slopes, wherever applicable, should be seeded and growth of vegetation permitted to limit soil erosion and sloughing.
- d. Drainage ditches sloping at a rate of 3 percent or greater should be seeded and/or protected with riprap or other erosion protection.
- e. Temporary excavation more than 4 feet (1.2 m) in depth should be sloped and/or shored according to OSHA requirements.
- f. Seepage water may be encountered at or above the proposed subgrade elevations in cut areas depending upon time of construction and amount of precipitation. The side ditches proposed in these locations are considered adequate to maintain the subgrade in a relatively dry condition.



Subsurface Investigation SR 15/US 20 Improvement Project No.: STP-4320 (3), CTL No. 00-050061 July 19, 2001, Revised August 15, 2001 Page 9

3. Site Preparation & Earthwork

a. All surface objects, vegetation, trees, tree stumps, topsoil and roots located within the construction limits, should be cleared and grubbed. Removal of the existing pavement, wherever needed, should be performed according to INDOT Standard Specifications, Section 203.22 and related sections.

On SR 15, it is estimated that an average of 13.75 inches (351 mm) of asphalt concrete will require removal. In some locations along SR 15, it is estimated that 5 to 19 inches (127 to 483 mm) of Portland cement concrete will require removal in addition to 3 to 6 inches of asphalt concrete. Elsewhere, it is estimated that 6 inches (152 mm) of topsoil will require removal.

On US 20, it is estimated that 2 to 3 inches of asphalt concrete and 4 to 12 inches of Portland cement concrete will require removal.

Please refer to the attached test boring records for pavement thickness and type.

- b. Subsequent to removal of existing pavement and topsoil and excavation to the bottom of the proposed subgrade treatment, the exposed soils should be compacted using a minimum of 20-ton vibratory roller in sand subgrade and proofrolled in cohesive soils according to INDOT Specifications.
- c. Soft and/or loose soils may be encountered beneath the new embankment between stations 10+510 and 10+550 Right of Line "C". Ponding water was observed at all times in this area during the field testing. Also, soft or loose soils may be encountered between stations 13+300 and 13+360 left of Line "C" due to an adjacent man-made pond. Also, soft soils may be encountered beneath in the leachfiled between stations 12+600 and 12+700 Right of Line "C". All soft or loose soils encountered in these locations should be removed and replaced with compacted fill.



Project No.: STP-4320 (3), CTL No. 00-050061

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Page 10

- d. Portland cement concrete slabs were encountered in the area of stations 10+600 to 10+15 in RB-6, RS-6A, RS-6B and RS-C. These slabs, wherever encountered beneath the proposed embankment and ditches, should be removed as necessary, and replaced with engineered fill. Note that the concrete slabs may extend north and south of stations 10+600 to 10+615.
- e. During earthwork operations, adequate drainage should be provided on the surface soils. Absorption of heavy rainfall, accumulations of water and heavy construction traffic may result in softening these soils, hence, severely weakening the strength of the subgrade soils.
- f. Temporary excavation more than 4 feet (1.2 m) in depth should be sloped and/or shored according to OSHA requirements.
- g. Excavation into the underlying soils to the proposed subgrade elevations may be accomplished using conventional excavation equipment.
- h. Groundwater may be encountered in excavations extending to or below a depth of 3 feet (1 m) beneath the proposed subgrade such as in RB-7 and RB-30. Seepage water may be encountered elsewhere depending upon time of construction and amount of precipitation.

V. CHANGED CONDITIONS

Should the layout plans for the proposed culverts and roadway be changed from those used in preparing this report, CTL Engineering should be notified to make the necessary modifications in our recommendations to account for the changed conditions.

VI. TESTING AND OBSERVATION

Experience shows that the subsurface soil conditions in an area sometimes vary from the ones indicated by the borings at their specific locations. It is therefore recommended that an Engineering Soil Technician, under the supervision of a qualified Geotechnical Engineer, be retained on the site to monitor the recommended soil bearing capacity and earthwork activities.



Subsurface Investigation SR 15/US 20 Improvement Project No.: STP-4320 (3), CTL No. 00-050061 July 19, 2001, Revised August 15, 2001

VII. CLOSURE

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CTL Engineering, Inc. has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analysis, conclusions and other work product of CTL Engineering are instruments of service for this project only.

Soil samples will be retained in our laboratory for 60 days, after which they will be discarded unless instructions are received from you as to their disposal.

CTL Engineering assignment does not include, nor does this geotechnical report address the environmental aspects of this site.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

Registration No. 60900551

al March

STATE OF STA

Paul L. Douglass, P.E.

Principal Engineer

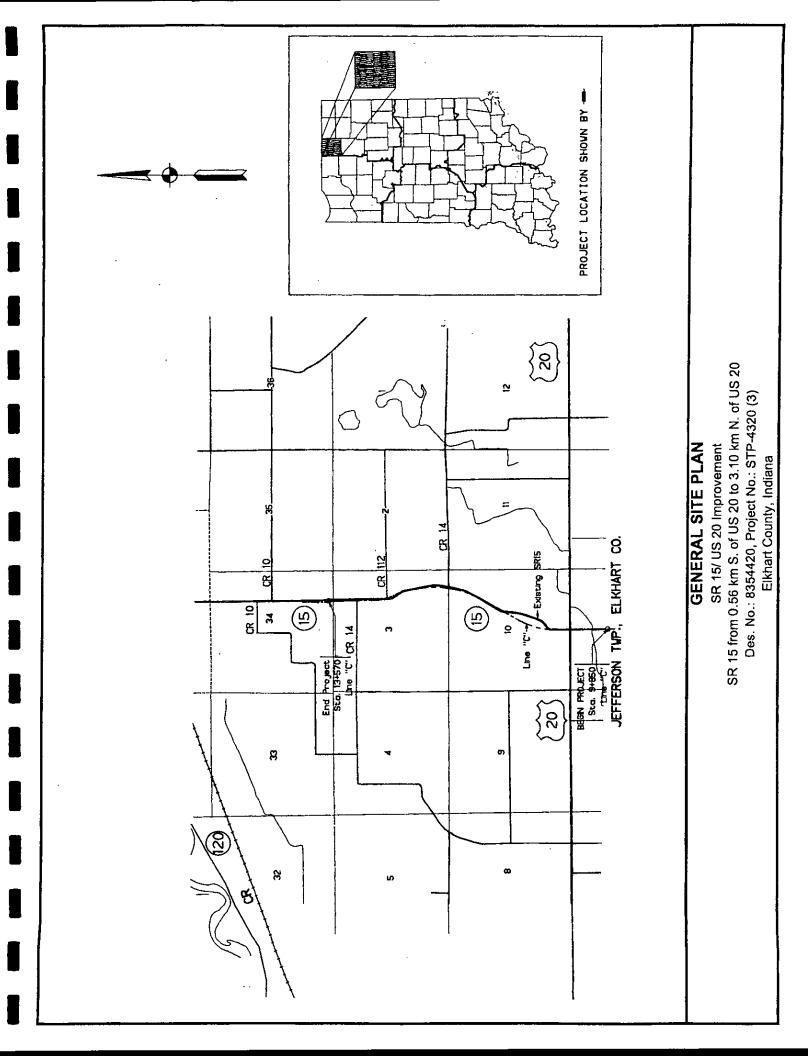
Registration No. 60012388

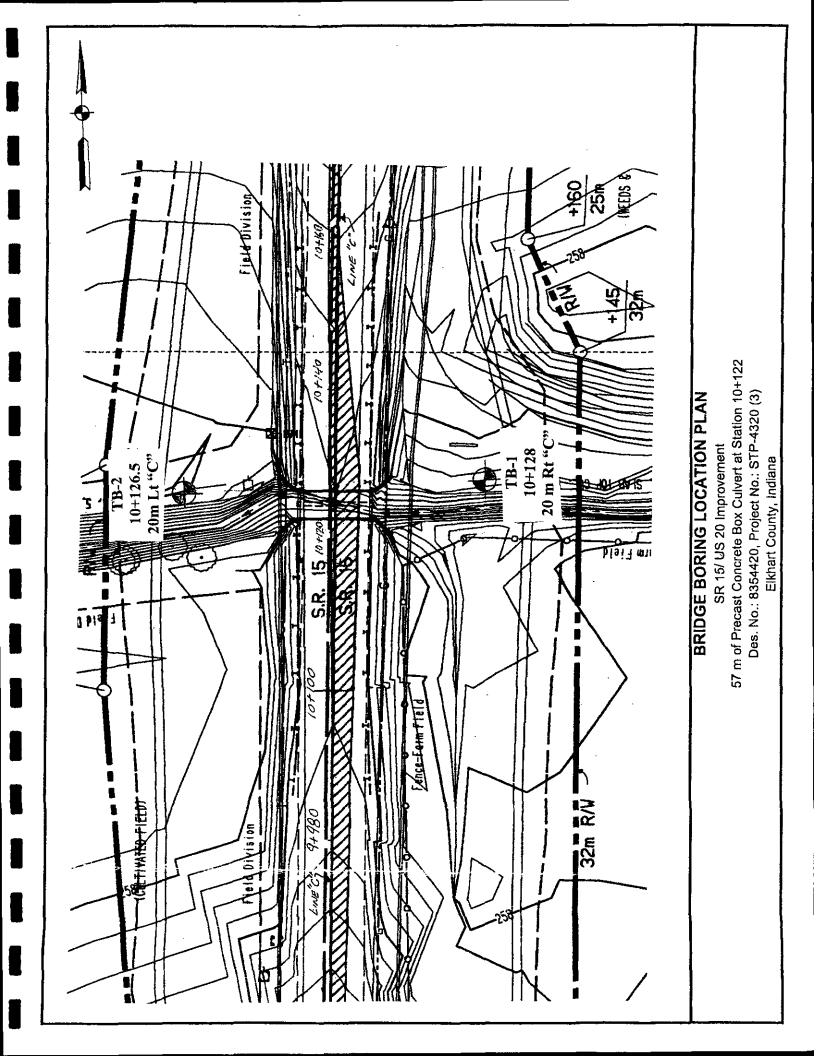


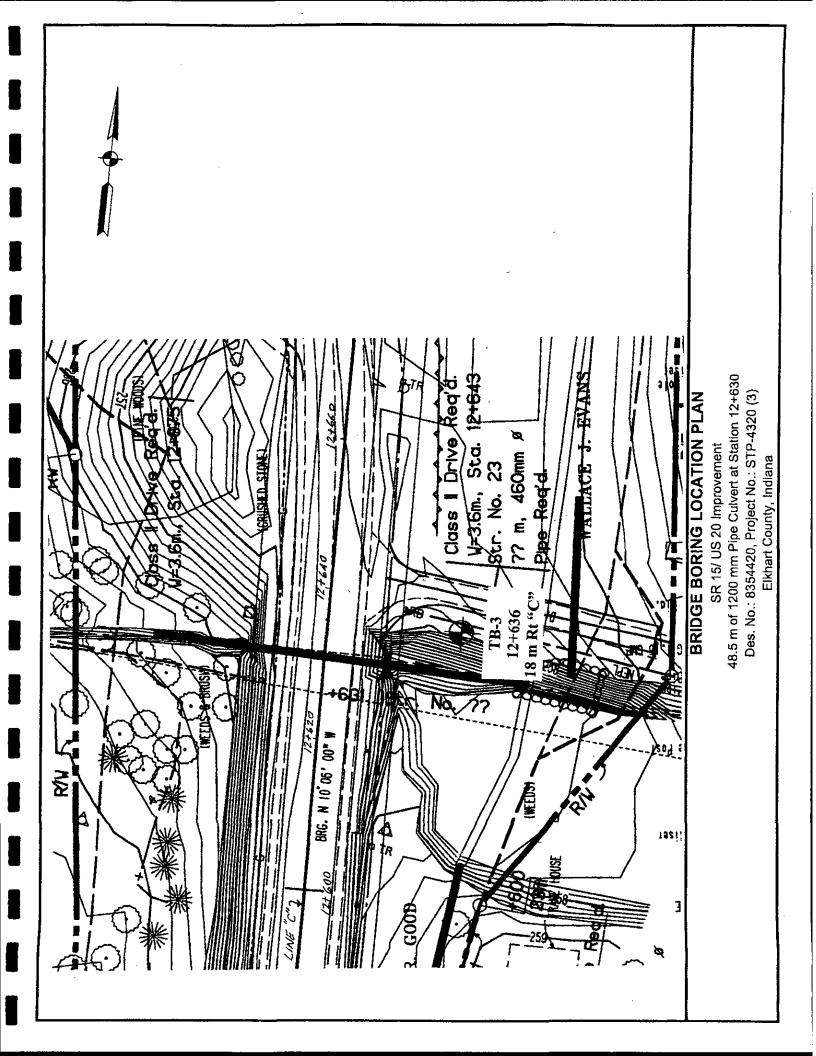
APPENDIX A

GENERAL SITE PLAN BORING LOCATION PLAN









APPENDIX B TEST BORING RECORDS



SOIL DESCRIPTION

NON-COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Loose Loose Medium Dense Dense Very Dense	6 - 10 11 - 30 31 - 50
COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Soft	4 - 5 6 - 10 11 - 15 16 - 30
GRADATION COMPONENT	SIZE
Boulders Gravel Pa Coarse Sand Pass Fine Sand Passing Silt Clay	ssing 3" Retained on #10 sing #10 Retained on #40 on #40 Retained on #200 . 0.075 mm to 0.002 mm
MOISTURE TERMS	DESCRIPTION
Dry Slightly Moist Moist Abo Very Moist Wet	Below Plastic ove Plastic, Below LiquidAt Liquid



TEST BORING RECORD BORING NO.: CLIENT : Indiana Department of Transportation OF SHEET 1 : SR 15/US 20 Improvement **PROJECT** DATE STARTED : 05-21-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-21-01 : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. BORING METHOD: HSA HAMMER : Automatic BORING ELEVATION: 268.80 m (USC&GS) **STATION** : 9+880 DRILLER : KO **RIG TYPE** : CME 55 Truck OFFSET : 3.5 m Rt TEMPERATURE: 75° F CASING DIA. : 83 mm : <u>"C"</u> LINE WEATHER : Sunny **CORE SIZE** DEPTH 2.29 m 24 hours Reading 2.00 m At Completion Dry E Caved in at 0.91 m GROUNDWATER: ▼ Encountered at Dry Unconfined Compression (kN/m²) Moisture Content (%) Atterberg Ê SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Limits Stratum Elevation SPT/ 30 (N) SOIL/MATERIAL DESCRIPTION Sample Number Sample Depth ш PL PI ASPHALT CONCRETE (457 mm) (Visual) 0.46 0 268.34 SS-1 0 0 67 Ö, 0 Brown, Slightly Moist, Very Loose, SAND AND **GRAVEL** (Visual) 0 4 6 1.22 267.58 SS-2 8 89 4 4 1.5 Light Brown, Slightly Moist, Loose to Medium Dense, SAND 7 (Visual) **SS-3** 8 16 89 2.29 266.51 Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings and pavement restored with concrete patch. 3.0_ NOTE: The 24-hours groundwater reading may be due to rain accumulated in the borehole. 4.5_ 6.0_ **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer SS - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Liquid Limit ST - Shelby Tube Sample SFA - Solid Flight Auger PL - Plastic Limit CR - Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring ы - Plasticity Index BS - Bag Sample Mud Drilling MD Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings WD - Wash Drilling Fax: 317-585-8621 Penetration Test - Hand Auger

TEST BORING RECORD BORING NO.: RB-2 : Indiana Department of Transportation CLIENT SHEET 1 OF PROJECT : SR 15/US 20 Improvement : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 05-21-01 LOCATION DATE COMPLETED: 05-21-01 : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic BORING METHOD : HSA BORING ELEVATION: 262.50 m (USC&GS) STATION : 10+000 : CME 55 Truck DRILLER : KO **RIG TYPE OFFSET** 3.5 m Lt TEMPERATURE: 75° F CASING DIA. : 83 mm LINE "C" WEATHER : Sunny **CORE SIZE DEPTH** 3.05_m **基** Caved in at 0.91 m 24 hours Reading 0.61 m At Completion Dry GROUNDWATER: Encountered at 2.74 m Unconfined Compression (kN/m²) Moisture Content (%) Atterberg SPT / 15cm Total Unit Weight (kg/m^{*}) Recovery (%) Limits Stratum Elevation SPT/ 30 SOIL/MATERIAL DESCRIPTION Sample Number Sample Depth Ê Pİ PL ASPHALT CONCRETE (152 mm) over PORTLAND CEMENT CONCRETE (229 mm) 0.38 262.12 (Visual) 9 **SS-1** 9 22 94 13 Brown, Slightly Moist, Medium Dense to Loose SAND A-1-b As Lab 4 3 8 100 1.37 SS-2 3 261.13 5 1.5 Brown, Slightly Moist, Medium Stiff to Stiff, SANDY CLAY LOAM 5 A-4 SS-3 15 100 18 As Lab 1 6 9 2.29 260.21 Brown, Wet, Medium Dense, SAND 4 (Visual) 19 78 SS-4 9 10 3.0 3.05 259.45 Bottom of Boring at 3.05 meters Boring backfilled with soil cuttings and pavement restored with concrete patch. NOTE: The 24-hours groundwater reading may be due to rain accumulated in the borehole. 4.5_ 6.0 **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer - Split Spoon Sample SS HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Shelby Tube Sample - Liquid Limit ST SFA - Solid Flight Auger - Plastic Limit PL CR - Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring ы - Plasticity Index BS - Bag Sample MD - Mud Drilling Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings WD - Wash Drilling Penetration Test Fax: 317-585-8621 HA - Hand Auger

TEST BORING RECORD BORING NO.: RB-3 : Indiana Department of Transportation CLIENT __1__ OF __1 SHEET **PROJECT** : SR 15/US 20 Improvement : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 05-15-01 LOCATION DATE COMPLETED: 05-15-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic **BORING METHOD: HSA** BORING ELEVATION: 261.40 m (USC&GS) STATION 10+240 : CME 55 Truck DRILLER : KO **RIG TYPE** OFFSET 10 m Rt TEMPERATURE: 70° F CASING DIA. : 83 mm LINE WEATHER : Sunny CORE SIZE **DEPTH** 2.29 m Caved in at 1.78 m At Completion 1.75 m Encountered at Dry GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) SPT/ 30 cm Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Limits Stratum Elevation Stratum Depth SOIL/MATERIAL DESCRIPTION Sample Number Sample Depth ы PL LL 0.15 TOPSOIL (152 mm) (Visual) 261.25 5 Brown, Moist, Loose, SANDY LOAM with **SS-1** 5 10 89 16 Traces of Roots 5 A-4 As Lab 3 0.76 260.64 3 SS-2 3 7 100 Brown, Slightly Moist, Medium Stiff to Very 1.5 Stiff, SANDY CLAY LOAM A-4 (0) Lab 1 6 18 11 SS-3 9 19 100 10 2.29 10 259.11 Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings. 3.0 4.5 6.0 **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Shelby Tube Sample LL - Liquid Limit SFA - Solid Flight Auger ST - Rock Core Sample - Plastic Limit CR PL Indianapolis, Indiana 46250 RC - Rock Coring BS - Bag Sample РΙ - Plasticity Index MD - Mud Drilling Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings WD - Wash Drilling Penetration Test Fax: 317-585-8621 HA - Hand Auger

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BORING ELEVATION : 289.00 m (USCAGS) BORING METHOD : INSA HAMMER Automatic STATION : 109-80 The STATIO	1		: SR 15 from 0.56 km S. to 3.10 km N. of US 2	20 in Elkhar	t Count	y				DAT	E STAR	TED	: 06-2	0-01	
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LINE CPT 3.05 m		-	N	G TYPE	:	<u>CME_55</u>	50 AT\	<u> </u>		1		_			
CTI. Engineering of Indiana, Inc. 83.0 Section of Boring at 3.05 meters Borund Section of Boring at 3.05 met	}			ASING DIA	. ;	83 mm				1					
SCIL/MATERIAL DESCRIPTION Head Section Scient Sc		DEF													
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GRAVEL (Fill) (152 mm) (Visual)	tum	iple th	SOIL/MATERIAL DESCRIPTION		atum	nple nber	Г/15ст	T/ 30 cm (N)	covery %)	Isture ntent (%)	al Unit ight /m')	confined mpression kN/m²)			
GRAVEL (Fill) (152 mm) (Visual) D. S. O.15 T. T. T. T. T. T. T. T. T. T. T. T. T.	Stra	Sam		l	Stra	Sar	SP	SP	Red (βÖ	<u> </u>	ร็ช	LL	PL	Pl
CTL Engineering of Indiana, Inc. SS-4 SS-4 SS-4 SS-5 SS-6			GRAVEL (Fill) (152 mm) (Visual)	þ. 7	0.15		7								
Brown with Gray Streaks, Moist, Medium Stiff to Stiff, SANDY CLAY LOAM A4 As Lab 1 Brown, Slightly Moist, Stiff, LOAM A4 As Lab 5 Brown, Slightly Moist, Stiff, LOAM A4 As Lab 5 Brown of Boring at 3.05 meters Boring backfilled with soil cuttings. NOTE: The 24-hours groundwater reading may be due to rain accumulated in the borehole. CTL Engineering of Indiana, Inc. BORING METHOD SAMPLING METHOD ABBREVIATIONS A53.0 East 75° Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 Phone: 317-585-8277 Phone: 317-585-8277 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana 46250 Phone: 317-585-8277 Politic Indianapolis, Indiana	264.24		A-4		0.76	SS-1	5	7	78	15					
to Siff, SANDY CLAY LOAM A-A As Lab 1 Brown, Slightly Moist, Stiff, LOAM A-A As Lab 5 Brown, Slightly Moist, Stiff, LOAM A-A S Lab 5 Bottom of Boring at 3.05 meters Boring backfilled with soil cuttings. NOTE: The 24-hours groundwater reading may be due to rain accumulated in the borehole. CTL Engineering of Indiana, Inc. 6330 East 75° Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 BORING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SS - Split Spoon Sample SS - Split Spoon Sample SS - Split Spoon Sample SS - Split Spoon Sample SS - Shelby Tube Sample SS - She	204.24	‡ 	Dayum with Croy Strooks Moiet Medium Stiff			SS-2	2	7	94	18					
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	ENGIN	EERING #	Phone: 317-505-0277	ND - Was	h Drillin	g	i i				1	PT - St	andard		

TEST BORING RECORD RB-5 BORING NO.: : Indiana Department of Transportation CLIENT SHEET OF : SR 15/US 20 Improvement **PROJECT** DATE STARTED : 05-15-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-15-01 : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. BORING METHOD : HSA **HAMMER** : Automatic BORING ELEVATION: 264.50 m (USC&GS) 10+480 **STATION** : CME 55 Truck DRILLER : KO **RIG TYPE OFFSET** 5 m Rt TEMPERATURE: 75° F CASING DIA. : 83 mm "C" LINE WEATHER : Sunny **CORE SIZE** 3.05 m **DEPTH** ∇ 24 hours Reading Dry At Completion Dry Caved in at 2.29 m ▼ Encountered at Dry GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) 틍 Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) E S Limits Stratum Elevation SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Depth SPT/ LL PL ы ASPHALT CONCRETE (356 mm) (Visual) 0.36 264.14 6 Gray changing to Brown, Slightly Moist, SS-1 8 13 100 13 Medium Dense, SANDY LOAM 5 As Lab 3 0.91 263.59 3 **SS-2** 6 16 67 11 10 Brown with Gray Streaks, Slightly Moist, Very 4 Stiff, LOAM (TILL) SS-3 7 17 100 A-4 As Lab 5 10 3 **SS-4** 7 16 100 3.05 3.0_ 9 261.45 Bottom of Boring at 3.05 meters Boring backfilled with soil cuttings and pavement restored with concrete patch. 4.5 6.0 ABBREVIATIONS BORING METHOD SAMPLING METHOD CTL Engineering of Indiana, Inc. - Hand Penetrometer HSA - Hollow Stem Auger - Split Spoon Sample 6330 East 75th Street, Suite 178 - Liquid Limit - Shelby Tube Sample LL SFA - Solid Flight Auger ST PL**Plastic Limit** CR - Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring - Plasticity Index ы - Mud Drilling BS - Bag Sample MD Phone: 317-585-8277 SPT - Standard - Wash Drilling AC - Auger Cuttings WD Penetration Test Fax: 317-585-8621 - Hand Auger

CTILE projecting of Indiana, Inc. Social Part Socia			TES	ТВО	RIN	G F	RECC	RD		-						
PROJECT : 9R 15US 20 Improvement LOCATION : 5R 15 Into 10.58 km s. to 3 to km s. of US 20 in Filthant Country DATE STARTED : 05-14-01 DATE STARTED : 05-14-01 DATE STARTED : 05-14-01 DATE COMPLITTED : 05-14-01	CLIENT	-	: Indiana Department of Transportation								BOR	RING NO	.:	RB	-6	
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DES NO. 3.834429_Project No. STP420_0], CTL No. 20450061 BORING ELEVATION 20500 1050	LOCAT	ION	: SR 15 from 0.56 km S. to 3.10 km N. of U	S 20 in El	khart C	ount	<u>/</u>				DAT	E STAR	TED :	05-1	4-01	
STATION 10*950	DES N	o									DAT	E COMP	LETED:	05-1	4-01	
OFFSET 10 m Lt	BORIN	G ELE	VATION : 263.00 m (USC&GS)	BORING	METH	OD :	HSA_				HAN	MER	:_A	utoma	atic	
LINE C C C C C C C C C				RIG TYP	E	:	CME 5	5 Truck	<u> </u>		DRII	LLER	: <u> K</u>	0		
DEPTH 1.22 m CORE SIZE Facuntiered at Dig Value Assertion Dig Value Assertion Dig Value Assertion Dig Value Assertion Value Assertion Dig Value Assertion Value Assertion Dig Value Value Assertion Value Valu				CASING	DIA.	:	83 mm				TEN	PERAT	JRE : <u>7</u>	0° F		
SOILMATERIAL DESCRIPTION LIU PL PI LIU PL PI SOILMATERIAL DESCRIPTION LIU PL PI			·	CORE SI	ZE	:						ATHER_	<u>: s</u>	unny		
TOPSOIL (152 mm) (Visual) Dark Gray, Slightly Moist, Medium Dense, SAND AND GRAVEL with Brick and Asphalt Concrete Fragments (FILL) (Visual) 262.09 261.78 PORTLAND CEMENT CONCRETE (Visual) Bottom of Boring at 1.22 meters. Boring terminated on possible old concrete slab. Boring backfilled with soil cuttings. CTL Engineering of Indiana, Inc. Boring backfilled with soil cuttings. SS-2 SS-2 SS-2 SS-2 SS-2 SS-2 SS-2 SS-2 SS-2 SS-3 ABPLING METHOD ABBREVIATIONS ABBREVIATIONS ABBREVIATIONS ABBREVIATIONS ABBREVIATIONS - Hard Fenetrometer SS - Spill Spoon Sample SS - Spill Spoon Samp	GROU	TAWON	ER: Encountered at Dry	At Comple	tion <u>D</u>	ry .	<u>Z</u>	24 hou	rs Rea	ding	Dry			eved in	at <u>1.2</u>	22 m
TOPSOIL (152 mm) (Visual) Dark Gray, Slightly Moist, Medium Dense, SAND AND GRAVEL with Brick and Asphall Concrete Fragments (FLLI) (Visual) 262.09 261.78 PORTLAND CEMENT CONCRETE (Visual) Bottom of Boring at 1.22 meters. Boring terminated on possible old concrete slab. Boring backfilled with soil cuttings. CTL Engineering of Indiana, Inc. Boring backfilled with soil cuttings. CTL Engineering of Indiana, Inc. Boring backfilled with soil cuttings. CTL Engineering of Indiana, Inc. Boring backfilled with soil cuttings. SS-2 SS-3 ABPLING METHOD ABBREVIATIONS ABBREVIATIONS - Hand Penetrometer SS-AD Jube Sample, CR. Rock Core Sample,	atum vation	nple pth	SOIL/MATERIAL DESCRIPTION	1	atum	pth	mple imber	7 / 15cm	77/ 30 cm (N)	covery (%)	oisture ontent (%)	otal Unit eight g/m³)	nconfined ompression (kN/m²)			
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ENGINEERING Phone: 317-585-8277 MD - Mud Drilling WD - Wash Drilling WD - Wash Drilling WD - Auger Cuttings PI - Plasticity Index SPT - Standard		41		SFA - S	Solid Fli	ight A		ST	- She	lby Tu	be Sa	mple Ll	•			
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	ENGINE	,ERIIVG 2				_	J	AC	- Aug	er Cul	ttings	s				st

		TES	ST BOP	RING	RECC	RD	<u> </u>						
CLIENT	Г	: Indiana Department of Transportation						BOF	RING NO	.:	RS-0	6A	
PROJE		: SR 15/US 20 Improvement						SHE	EΤ	1	0	=	1
LOCAT	ION	: SR 15 from 0.56 km S. to 3.10 km N. of	US 20 in Ell	chart Coun	ty			DAT	E STAR	TED :	05-1	4-01	
DES N	٥.	: 8354420, Project No.: STP-4320 (3), CT	L No.: 00-05	0061				DAT	E COMP	LETED:	05-1	4-01	
BORIN	G ELE	VATION : 263.00 m (USC&GS)	BORING	METHOD	HSA_			_ HAN	MER	: <u>A</u>	utoma	itic	
		TION : 10+605	RIG TYPE	Ξ	CME 5	5 Truck		DRI	LLER	: <u> K</u>	0		
	LIN	SET : 10 m Lt	CASING I	DIA.	83 mm			_ TEN	IPERATI	JRE : 7	0° F		
	DEF	PTH : 0.94 m	CORE SI					WE	ATHER	: S	unny		
GROU	NDWAT	ER: Tencountered at Dry	At Comple	tion <u>Dry</u>						<u>I</u> Ca	eved in	at <u>0.9</u>	91 m
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTIO)N	Stratum Depth	Sample Number	SPT / 15cm	(N) Recovery	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)		terbei Limits	
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_		6330 East 75 th Street, Suite 178	HSA - H	ollow Sterr	Auger		Split Spo				nd Per uid Lir		neter
	TI	Indianapolis, Indiana 46250		olid Flight a ock Coring			Shelby T Rock Co			L - Pla	stic Li	mit	
ENGINE	ERING #	Phone: 317-585-8277	MD - M	lud Drilling		BS -	Bag San	ıple	P	l - Pla PT - Sta	sticity		(
		Fax: 317-585-8621		/ash Drillin and Auger		AC -	Auger C	aungs			netrati		st

		TES	T BOR	NG F	RECC	RD	_							
CLIENT		: Indiana Department of Transportation							BOR	ING NO	••	RS-0	06B	
PROJE		: SR 15/US 20 Improvement							SHE	ET	1	_ 0	F	1
LOCAT		: SR 15 from 0.56 km S. to 3.10 km N. of U	JS 20 in Elkha	art Coun	ly				DAT	E STAR	TED :	05-1	4-01	
DES NO		: 8354420, Project No.: STP-4320 (3), CTI							DAT	E COMP	LETED :	05-1	4-01	
		VATION : 263.00 m (USC&GS)	BORING ME		HSA				HAM	MER	: <u> </u>	utoma	atic	
ĺ	STA	TION : 10+610	RIG TYPE		: <u>CME</u> 5	5 Truck			DRIL	LER.	: <u> </u>	0		
ł	OFF LINI	SET : 10 m Lt	CASING DI	۹.	: 83 mm				TEM	PERATI	JRE : _7	0° F		
	DEF		CORE SIZE		; <u> </u>				WE/	THER	: S	unny		
GROU	NDWAT	ER: Encountered at Dry T	At Completio	n <u>Dry</u>							TĒL Ca	eved in	n at <u>0.</u> 9	91 m
Stratum Elevation	ple	SOIL/MATERIAL DESCRIPTIO	N	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m²)	Unconfined Compression (kN/m²)	A	tterbei Limits	rg (
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		CTL Engineering of Indiana, Inc.	HSA - Holl	OW Sterr			MPLIN Split						TIONS	
1	77	6330 East 75 th Street, Suite 178	SFA - Soli	d Flight	Auger	ST -	- Shelb	y Tut	e Sa	mple Li	L - Liq	uid Lii	mit	
		Indianapolis, Indiana 46250	F .	k Coring I Drilling			- Rock - Bag S			ple P	_	istic L isticity	imit Index	ζ.
ENGINE	ERING #	Phone: 317-585-8277	WD - Was				- Auge				PT - Sta	indarc		

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CLIENT	-	: Indiana Department of Transportation					_		BOF	RING NO	.:	RS-	06C	
PROJE		: SR 15/US 20 Improvement							SHE	ET	1	_ 0	F	1
LOCAT		: SR 15 from 0.56 km S. to 3.10 km N. of	JS 20 in Elkh	art Coun	ty		_		ĐAT	E STAR	TED :	06-2	21-01	
DES N		: 8354420, Project No.: STP-4320 (3), CT							DAT	E COMF	LETED	: 06-2	21-01	
		VATION : 263.00 m (USC&GS)	BORING M		HSA				HAN	MER	:_ A	utom	atic	
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Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	N	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	A	tterbei Limits	rg
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4		Auger Refusal @ 0.76 meters.						Į						
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	1.5_	Boring terminated on possible old concre	e slab.											
		Boring backfilled with soil cuttings.		-	,]		}] ,					
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	<u> </u>	CTL Engineering of Indiana, Inc.		NG MET		SS	AMPL	ING M	_				TIONS netron	
	L	6330 East 75th Street, Suite 178	HSA - Hol SFA - Soi			ST		t Spoo			L - Liq	uid Li	mit	
	IL	Indianapolis, Indiana 46250	RC - Roo	k Coring	l	CR		k Con		ple P	_	istic L	imit Index	•
ENGINE	ERING #	Phone: 317-585-8277		d Drilling sh Drillin		BS AC		Sam er Cu			PT - Sta	andard	i	
1		Fax: 317-585-8621		nd Auger							Pe	netrat	ion Te	st

TEST BORING RECORD BORING NO.: **RB-7** : Indiana Department of Transportation CLIENT SHEET 1 OF PROJECT SR 15/US 20 Improvement : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County **DATE STARTED** : 05-14-01 LOCATION DATE COMPLETED: 05-14-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic BORING METHOD: HSA BORING ELEVATION: 269.00 m (USC&GS) 10+720 **STATION** DRILLER : CME 55 Truck : KO **RIG TYPE OFFSET** 5 m Rt TEMPERATURE: 75° F CASING DIA. : 83 mm "C" LINE WEATHER : Sunny **CORE SIZE DEPTH** 5.33 m ∑ 24 hours Reading 2.26 m At Completion 3.05 m Caved in at 3,05 m GROUNDWATER: Encountered at 2.59 m Unconfined Compression (kN/m²) Atterberg SPT / 15cm Recovery (%) Total Unit Weight (kg/m³) Moisture Content (Limits Stratum Elevation SPT/ 30 SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth ĻĻ PL PI 4 SS-1 8 19 94 17 11 15 BS-1 15 29 14 Brown, Slightly Moist, Very Stiff, CLAY A-6 (7) 6 Lab 2 SS-2 12 28 100 13 16 1.5 10 1.83 267.17 SS-3 11 27 100 Brown, Moist, Medium Dense, SANDY LOAM 16 As Lab 3 2.44 266.56 9 78 **SS-4** 27 13 14 Brown, Wet, Medium Dense, SAND (Visual) 3.81 265.19 4 **SS-5** 13 28 100 19 Gray, Slightly Moist, Very Stiff to Stiff, CLAY 4.5 15 LOAM (TILL) (Visual) SS-6 6 15 89 5.18 263.82 Gray, Wet, Medium Dense, SAND (Visual) 5.33 263.67 Bottom of Boring at 5.33 meters Boring backfilled with soil cuttings. Bag samples for Standard Proctor and CBR 6.0 testing were obtained at .15m to .91m. **ABBREVIATIONS BORING METHOD** SAMPLING METHOD CTL Engineering of Indiana, Inc. - Hand Penetrometer HSA - Hollow Stem Auger SS Split Spoon Sample 6330 East 75th Street, Suite 178 - Liquid Limit - Shelby Tube Sample LL SFA - Solid Flight Auger ST Plastic Limit CR - Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring - Plasticity Index - Mud Drilling - Bag Sample BS MD Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC - Auger Cuttings Penetration Test Fax: 317-585-8621 - Hand Auger

TEST BORING RECORD BORING NO.: RB-8 CLIENT : Indiana Department of Transportation SHEET 1 OF **PROJECT** : SR 15/US 20 Improvement : 05-22-01 DATE STARTED : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-22-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic BORING METHOD: HSA BORING ELEVATION: 267.65 m (USC&GS) DRILLER STATION : 10+840 : KO RIG TYPE : CME 55 Truck OFFSET C/L TEMPERATURE : 75° F CASING DIA. : 83 mm LINE "C" WEATHER : Sunny **CORE SIZE** 4.57 m DEPTH E Caved in at 3.96 m At Completion Dry ▼ Encountered at <u>Dry</u> GROUNDWATER: Unconfined Compression (kN/m²) Atterberg SPT / 15cm Recovery (%) Total Unit Weight (kg/m²) Moisture Content (9 Limits Stratum Elevation SPT/30 SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth £ LL PL Ы 3 SS-1 4 8 89 9 4 Brown, Moist, Medium Stiff to Very Stiff, SANDY CLAY LOAM 8 As Lab 1 SS-2 7 20 67 13 1.5 6 1.83 265.82 **SS-3** 6 14 89 Brown, Moist, Medium Dense, SAND 8 A-1-b As Lab 4 2.44 265.21 4 100 15 SS-4 9 24 15 3.0 Brown, Slightly Moist, Very Stiff, SANDY **CLAY LOAM** with Sand Layers A-4 As Lab 1 15 4.27 263.38 83 **SS-5** 20 37 Light Brown, Slightly Moist, Very Dense, SAND A-1-b As Lab 4 4.57 17 263.08 Bottom of Boring at 4.57 meters Boring backfilled with soil cuttings. 6.0 ABBREVIATIONS BORING METHOD SAMPLING METHOD CTL Engineering of Indiana, Inc. - Hand Penetrometer - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Shelby Tube Sample - Liquid Limit ST SFA - Solid Flight Auger PL - Plastic Limit Indianapolis, Indiana 46250 CR - Rock Core Sample RC - Rock Coring - Plasticity Index - Mud Drilling - Bag Sample B\$ MD Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC - Auger Cuttings Penetration Test Fax: 317-585-8621 - Hand Auger HA

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CLIENT	r	: Indiana Department of Transportation								BOF	RING NO).:	RB	-9	
PROJE		: SR 15/US 20 Improvement						_		SHE	ET	1	0	F	1
LOCAT		: SR 15 from 0.56 km S. to 3.10 km N. of L	JS 20 in	Elkhar	t Count	ty				DAT	E STAR	TED	: 05-0	19-01	
DES N		: 8354420, Project No.: STP-4320 (3), CTL								DAT	E COM	PLETED	: 05-0	19-01	
	-	VATION : 268.43 m (USC&GS)	BORIN			HSA			-	HAN	MER	: <u> </u>	utoma	atic	
		TION : 10+960	RIG TY	/PE		CME 5	5 Truck	ζ		DRI	LLER	:_ k	O		
		SET : C/L	CASIN	G DIA		83 mm				TEN	1PERAT	URE : _7	0° F		
	LINE		CORE							WE	ATHER	: 8	Sunny		
GROU	NDWAT		At Com		3.61 r	n 又	24 hou	rs Rea	ading	<u>1.47 m</u>	1	喜 C	aved in	n at <u>2.</u>	<u>59 m</u>
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	N		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m²)	Unconfined Compression (kN/m²)	A	tterber Limits	
	ဖွဲ့ရ	TORONI (452 mm) (Minus)	 .		ە <u>0</u> .15	υZ	S	-	æ	≥0	->=	150	LL	PL	PI
268.28_		TOPSOIL (152 mm) (Visual)			.U. 13	!	1								
	TX	Brown, Slightly Moist, Very Loose, SAND (Visual)			0.64	SS-1	1 2	3	89						
267.82_	\ \	Brown, Moist, Loose, SANDY LOAM with	Net	Hir	_0.61		3								
	I⊿X	Sand Seams	,,,,,	[]][]		SS-2	4	9	94	15					
267.36	T 1,	A-4 As Lab 3		 	1.07		5 2								
7	¥1.5					SS-3	3 5	8	100						
		Brown, Moist, Medium Stiff, LOAM (TILL) A-4 As Lab 5				SS-4	0 3 3	6	89	19					
265.53 _.	3.0/				2.90	SS-5	7 6 8	14	89				i,		
	- 	Brown, Wet, Medium Dense, SAND (Visu	al)			SS-6	6 7 10	17	78			:			<u>.</u>
264.01 263.86		Brownish Gray, Moist, Very Stiff, LOAM (A-4 As Lab 5 Bottom of Boring at 4.57 meters Boring backfilled with soil cuttings.	TILL) /		4.42 4.57	SS-7	9 13 12	25	94						
	6.0														
		CTL Engineering of Indiana, Inc.	1		G METI					ETHO				TIONS netrom	
ENGINE	ERING	6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277	SFA - RC - MD -	- Solid - Rock - Mud	w Stem Flight a Coring Drilling h Drillin	ı	ST	- She - Roo - Bag	iby Tu		imple Liple F	L - Lic PL - Pla	juid Lir astic L asticity	mit imit Index	
ĺ		Fax: 317-585-8621			וווווזע ה Auger Auger			Aut	, J. Ju	93	- 1			ion Te	st

TEST BORING RECORD BORING NO.: _ **RB-10** : Indiana Department of Transportation CLIENT OF SHEET : SR 15/US 20 Improvement **PROJECT** DATE STARTED : 05-09-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DATE COMPLETED: 05-09-01 DES NO. HAMMER : Automatic BORING METHOD: HSA BORING ELEVATION: 279.35 m (USC&GS) STATION 11+020 DRILLER : KO : CME 55 Truck **RIG TYPE OFFSET** 20 m Lt TEMPERATURE: 70° F CASING DIA. : 83 mm "C" LINE WEATHER : Sunny **CORE SIZE DEPTH** 13.72 m Σ 24 hours Reading <u>6.81 m</u> At Completion Dry Caved in at 6.83 m Encountered at Dry GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) Atterberg Limits SPT/ 30 cm SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Stratum Elevation Stratum Depth Sample Number SOIL/MATERIAL DESCRIPTION Sample Depth Ê PI ᄔ PL TOPSOIL (152 mm) (Visual) 0.15 279.20 6 **SS-1** 5 10 89 14 5 Brown, Moist, Loose, SANDY LOAM with 2 Sand Seams SS-2 3 100 6 A-4 As Lab 3 3 1.5_ 1 3 SS-3 14 10 94 1.98 277.37 7 4 **SS-4** 8 16 94 Brown, Moist, Loose to Medium Dense, SANDY LOAM A-4 (0) Lab 3 3 **\$S-5** 4 14 13 1 10 100 14 4.5 6 9 **SS-6** 7 16 89 5.94 273.41 6.0 9 Continued on next page SAMPLING METHOD ABBREVIATIONS **BORING METHOD** CTL Engineering of Indiana, Inc. SS - Split Spoon Sample - Hand Penetrometer HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 Shelby Tube Sample Liquid Limit LL SFA - Solid Flight Auger - Plastic Limit PL CR Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring - Plasticity Index BS MD - Mud Drilling Bag Sample Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings WD - Wash Drilling Fax: 317-585-8621 Penetration Test HA - Hand Auger

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CLIENT	: Indiana Department of Transportation							BOF	RING NO	i.:	RB	-10	
PROJECT	: SR 15/US 20 Improvement					-		SHE	ET	2	0	F	2
Stratum Elevation Sample	SOIL/MATERIAL DESCRIPTION	İ	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	A	tterbe Limits	rg
Sar Ee			Str	Sai	S	တီ	8	နိုပိ	Ke Ke	58	LL	PL	Р
9.0_	Light Brown, Moist to Slightly Moist, Medium Dense to Loose, SAND A-1-b As Lab 4	m		SS-7 SS-8 SS-9	5 12 12 3 11 15 5 7 11	26	78 78						
66.40 - - - - 65.63 - -	Light Brown, Slightly Moist, Medium Dense SAND (Visual) Bottom of Boring at 13.72 meters Boring backfilled with soil cuttings.		_12.95 _13.72	SS-11	1 6 17	23	78						
<u>_</u> l	CTI Engineering of Indiana Inc.	BORING	METH	OD	S	AMPLII	NG ME	THO	<u> </u>	ABBR	EVIA	i Tions	<u>. </u>
ENGINEERING	Indianapolis, Indiana 46250 Phone: 317-585-8277	HSA - Hollow SFA - Solid I RC - Rock (MD - Mud E WD - Wash HA - Hand	v Stem Flight A Coring Prilling Drilling	Auger uger	SS ST CR BS	- Split - Shel - Rock - Bag - Auge	Spoor by Tul Core Samp	n Sam be San Samp le	ple * mple LL ple Pl	- Har - Liqu - Plas - Plas PT - Sta	id Per uid Lir stic Li sticity ndard	netrom nit mit Index	ete

TEST BORING RECORD BORING NO.: **RB-11** CLIENT : Indiana Department of Transportation SHEET OF : SR 15/US 20 Improvement **PROJECT** DATE STARTED : 05-10-01 SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-10-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. HAMMER : Automatic BORING ELEVATION: 279.20 m (USC&GS) **BORING METHOD: HSA** : 11+020 DRILLER **STATION** : KO : CME 55 Truck **RIG TYPE OFFSET** 20 m_Rt TEMPERATURE : 70° F CASING DIA. : 83 mm LINE "C" WEATHER : Sunny CORE SIZE 13.72 m DEPTH Caved in at 6.55 m At Completion Dry Encountered at Dry GROUNDWATER: Unconfined Compression (kN/m²) SPT/ 30 cm (N) Moisture Content (%) Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Limits Stratum Elevation Stratum Depth Sample Number SOIL/MATERIAL DESCRIPTION Sample Depth LL PL PI 0.15 TOPSOIL (152 mm) (Visual) 279.05 5 **SS-1** 4 9 78 5 Brown, Slightly Moist, Loose to Very Loose, SANDÝ LŎAM 2 As Lab 3 3 SS-2 5 72 2 1.52 277.68 5 SS-3 4 12 89 8 3 Brown, Moist, Medium Dense, SAND (Visual) SS-4 4 12 100 8 3.0 3.81 275.39 5 SS-5 6 100 17 18 Brown, Slightly Moist, Very Stiff, CLAY with 12 Sand Seams A-6 As Lab 2 5.33 273.87_ Light Brown, Moist Changing to Slightly Moist, 4 Medium Dense to Very Dense, SAND **SS-6** 12 29 61 A-1-b 6.0 17 As Lab 4 Continued on next page SAMPLING METHOD ABBREVIATIONS **BORING METHOD** CTL Engineering of Indiana, Inc. - Split Spoon Sample Hand Penetrometer SS HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 Liquid Limit Shelby Tube Sample LL SFA - Solid Flight Auger ST - Plastic Limit PL Indianapolis, Indiana 46250 CR - Rock Core Sample RC - Rock Coring **Plasticity Index** BS - Bag Sample MD - Mud Drilling Phone: 317-585-8277 - Auger Cuttings SPT - Standard AC WD - Wash Drilling Penetration Test Fax: 317-585-8621 HA - Hand Auger

	<u> </u>	TEST	BORI	NG F	RECO	RD	· 							
CLIENT	r .	Indiana Department of Transportation							BOF	RING NO).:	RB.	-11	
PROJE		SR 15/US 20 Improvement							SHE	ET	2	0	F 2	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m [*])	Unconfined Compression (kN/m²)	A	tterber Limits	g
Stra	San			Str	Sar	S.	SP	Re (ဋိပိ	رُدٌ ≹ مُ	58	LL	PL	PI
¥	7.5				SS-7 SS-8	7 18 19	37 57	100 78						
	10.5	Light Brown, Moist Changing to Slightly Mois Medium Dense to Very Dense, SAND A-1-b As Lab 4	st,		SS-9	5 12 14	26	78						
	12.0_			12.95	SS-10	2 5 7	12	94						
266.25 265.48	3.5	Light Brown, Slightly Moist, Medium Dense SAND (Visual) Bottom of Boring at 13.72 meters Boring backfilled with soil cuttings.		13.72	SS-11	3 7 13	20	89						
	EERING M	CTL Engineering of Indiana, Inc. 6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 Fax: 317-585-8621	HSA - Hollo SFA - Solio RC - Rock MD - Mud WD - Was	f Flight of k Coring Drilling	Auger Auger I		- Roo - Bag	it Spor elby Tu ck Cor g Sam	on Sar ube Sa re Sarr	mple tample l	- Ha L - Lic PL - Pla PI - Pla SPT - St	ind Pe quid Li astic L asticit andar	.imit y Index	neter

SR_15 00-5061.GPJ CTLMET.GDT

TEST BORING RECORD BORING NO.: CLIENT : Indiana Department of Transportation SHEET 1 OF **PROJECT** : SR 15/US 20 Improvement DATE STARTED : 05-10-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-10-01 : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. BORING METHOD: HSA HAMMER : Automatic BORING ELEVATION: 280.30 m (USC&GS) : 11+080 DRILLER : KO **STATION RIG TYPE** : CME 55 Truck **OFFSET** 30 m Rt TEMPERATURE: 70° F : 83 mm CASING DIA. "C" LINE WEATHER Sunny **CORE SIZE DEPTH** 13.72 m At Completion Dry 24 hours Reading <u>Dry</u> Laved in at 11.20 m GROUNDWATER: Encountered at Dry Unconfined Compression (kN/m²) Moisture Content (%) Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Limits Stratum Elevation SPT/30 SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth £ ы PL 0.15 TOPSOIL (152 mm) (Visual) 280.15 4 Brown to Gray, Moist Loose, SANDY LOAM SS-1 5 8 78 3 As Lab 3 0.76 279.54 2 3 7 100 SS-2 4 0 SS-3 0 4 94 14 Brown, Moist to Slightly Moist, Soft to Very Stiff, SANDY CLAY LOAM A-4 As Lab 1 36345 314.016.7 6 17 100 **SS-4** 11 11 3.0 3.81 276.49 6 12 19 56 **SS-5** 8 11 Gray, Moist, Very Stiff, SANDY CLAY LOAM As Lab 1 5 **SS-6** 5 14 78 5.94 274.36_ 6.0 9 Continued on next page **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Liquid Limit - Shelby Tube Sample SFA - Solid Flight Auger - Plastic Limit - Rock Core Sample PL CR Indianapolis, Indiana 46250 RC - Rock Coring BS - Bag Sample - Plasticity Index - Mud Drilling ΜĐ Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC - Auger Cuttings Penetration Test Fax: 317-585-8621 - Hand Auger

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CLIEN	r	: Indiana Department of Transportation							BOF	RING NO).:	RB.	-12	
PROJE		: SR 15/US 20 Improvement					_		SHE	EΤ	2	0	F	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	ı	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m')	Unconfined Compression (kN/m²)	A.	tterbei Limits PL	rg PI
273.44_	7.5	Brown, Slightly Moist, Stiff, LOAM with San Seams A-4 As Lab 5	id III	6.86	SS-7	5 11 12	23	94	u	F > 0	10	LL		
	9.0	Light Brown, Moist to Slightly Moist, Mediu Dense, SAND	m		SS-8	2 7 10	17	100	5					
	0.5_	Ā-1-b As Lab 4			SS-9	4 3 18	21	78						
267.35	12.0			12.95	SS-10	3 8 10	18	89						
266.58	13.5	Light Brown, Slightly Moist, Medium Dense SAND (Visual) Bottom of Boring at 13.72 meters Boring backfilled with soil cuttings.	9,	13.72	SS-11	5 11 19	30	100						
		CTL Engineering of Indiana, Inc.		G METH			AMPLI						TIONS	
ENGINE	TL EERING #	6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 Fax: 317-585-8621	HSA - Holld SFA - Solid RC - Rock MD - Mud WD - Was HA - Hand	Flight A Coring Drilling h Drilling	Auger	ST CR BS	- Split - She - Roci - Bag - Aug	lby Tui k Core Samp	be Sar Samp le	nple LL ple Pl	- Liqu L - Pla: - Pla: PT - Sta	uid Lin stic Lii sticity ndard		

TEST BORING RECORD **RB-13** BORING NO.: CLIENT : Indiana Department of Transportation SHEET OF **PROJECT** : SR 15/US 20 Improvement DATE STARTED : 05-22-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-22-01 : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. BORING METHOD: HSA **HAMMER** : Automatic BORING ELEVATION: 271.00 m (USC&GS) : <u>11+218</u> **STATION** DRILLER : KO **RIG TYPE** : CME 55 Truck **OFFSET** C/L TEMPERATURE: 75° F CASING DIA. : 83 mm LINE "C" WEATHER : Sunny **CORE SIZE DEPTH** 7.62 m 24 hours Reading 2.13 m At Completion 6,10 m ☑ Caved in at 3.35 m Encountered at 2.74 m GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) Atterberg Ē SPT / 15cm Total Unit Weight (kg/m²) Recovery (%) Limits Stratum Elevation SPT/ 30 SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth Ê LL ы PL TOPSOIL (152 mm) (Visual) 0.05 270.95 2 Brown, Moist, Very Loose, SAND with Traces SS-1 2 100 of Roots (Visual) 2 0.76 270.24 1 **SS-2** 2 5 89 3 3 SS-3 3 6 100 18 3 Brown, Moist, Soft to Medium Stiff, SANDY **CLAY LOAM** A-5 As Lab 1 0 2 56 **SS-4** 4 3.0 2 3.81 267.19 3 **SS-5** 4 9 100 11 5 Brown Changing to Gray, Moist, Medium Stiff to Stiff, LOAM A-4 As Lab 5 4 **SS-6** 5 13 89 10 8 6.10 264.90 Continued on next page **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer SS - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Liquid Limit SFA - Solid Flight Auger ST - Shelby Tube Sample - Plastic Limit Indianapolis, Indiana 46250 RC - Rock Coring CR - Rock Core Sample ы - Bag Sample - Plasticity Index BS MD - Mud Drilling Phone: 317-585-8277 WD - Wash Drilling SPT - Standard AC - Auger Cuttings Penetration Test Fax: 317-585-8621 HA - Hand Auger

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CLIEN	Т	: Indiana Department of Transportation					_		BOF	RING NO	D.:	RB-	-13	
PROJE		: SR 15/US 20 Improvement					_	,	SHE	EET	2	0	F	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTIO	N	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m ⁻⁾	Unconfined Compression (kN/m²)		tterbe Limits	;
<u> </u>	ਔĞ		1111	ΩĞ	ΰŽ	<u>~</u>	S	œ	ΣŬ	<u> </u>	, 5ŭ	Ц	PL	PI
263.38_	7.5	Gray, Slightly Moist, Very Stiff, LOAM A-4 As Lab 5 Bottom of Boring at 7.62 meters Boring backfilled with soil cuttings. Dozer used to pull drilling rig.		_7.62	SS-7	4 10 14	24	94						
	9.0	Dozer used to pull drawing rig.												
	12.0	CTL Engineering of Indiana, Inc.	BORING	METH	OD	S	AMPLI	NG ME	ETHOL		ABBR	ŒVIA1	TIONS	
ÉNGINE	ERING #	6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 Fax: 317-585-8621	HSA - Hollov SFA - Solid RC - Rock MD - Mud I WD - Wash HA - Hand	v Stem Flight A Coring Drilling Drilling	Auger Auger	SS ST CR BS	- Split - Shel - Rock - Bag - Aug	Spoor by Tulk Core Samp	n Sam be Sar Samp le	ple * nple LI ple P	- Han - Liqu L - Plas I - Plas PT - Sta	d Pen uid Lim stic Lin sticity	etrom nit mit Index	eter

TEST BORING RECORD BORING NO.: **RB-14** : Indiana Department of Transportation CLIENT SHEET 1 OF : SR 15/US 20 Improvement **PROJECT** : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 05-16-01 LOCATION DATE COMPLETED: 05-16-01 : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic BORING METHOD: HSA BORING ELEVATION: 270.65 m (USC&GS) STATION : 11+320 : CME 55 Truck DRILLER : KO **RIG TYPE** OFFSET : 3 m Rt TEMPERATURE : 75° F CASING DIA. : 83 mm LINE : <u>"C"</u> : Rain **CORE SIZE** WEATHER DEPTH 6.10 m At Completion Dry 24 hours Reading Dry Caved in at 5.33 m GROUNDWATER: Encountered at Dry Unconfined Compression (kN/m²) SPT/ 30 cm (N) Moisture Content (%) Atterberg SPT / 15cm Total Unit Weight (kg/m²) Recovery (%) Limits Stratum Elevation SOIL/MATERIAL DESCRIPTION Sample Number Stratum Sample Depth ᄔ PL ы ASPHALT CONCRETE (279 mm) (Visual) 0.28 270.37 **SS-1** 3 7 100 4 Brown, Moist, Loose, SANDY LOAM As Lab 3 2 18 78 SS-2 3 6 3 1.5 268.97 3 SS-3 3 78 6 વ 19 SS-4 2 5 89 3.0 Brown, Moist, Medium Stiff to Soft, SANDY **CLAY LOAM** A-4 As Lab 1 **SS-5** 2 5 89 4.5 5.79 264.86 SS-6 100 7 18 Light Brown, Slightly Moist, Medium Dense, 6.0 SAND A-1-b As Lab 4 11 6.10 264.55 Bottom of Boring at 6.10 meters Continued on next page **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer - Split Spoon Sample SS HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 ST - Shelby Tube Sample - Liquid Limit SFA - Solid Flight Auger - Plastic Limit - Rock Core Sample PL Indianapolis, Indiana 46250 RC - Rock Coring CR ы - Plasticity Index MD - Mud Drilling BS - Bag Sample Phone: 317-585-8277 AC - Auger Cuttings SPT - Standard WD - Wash Drilling Fax: 317-585-8621 Penetration Test HA - Hand Auger

		TES	T BORI	NG I	RECO	RD								
CLIEN	Г	: Indiana Department of Transportation							BOF	RING NO).: <u></u>	RB-	14	
PROJE		: SR 15/US 20 Improvement	<u></u>					_	SHE	ET	2	0	F	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	l	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	A LL	tterbe Limits PL	rg Pl
<u> </u>	ÖÖ	Boring backfilled with soil cuttings and		00	62	0)	- J	<u></u>	20	->-			FL.	
	7.5	Boring backfilled with soil cuttings and pavement restored with concrete patch.												
<u> </u>		OTI Faring attending to	BORIN	G MET	HOD		AMPL	ING M	IETHO		ABB	REVIA	TION	 S
_		CTL Engineering of Indiana, Inc. 6330 East 75 th Street, Suite 178	HSA - Holle	w Sten	n Auger	SS	- Spli	t Spoo	on Sar	nple *	- Ha	nd Pe	netron	
	77/		SFA - Solid	f Flight	Auger	ST	- She		ube Sa e Sam			quid Li astic L		
CUOU	EERWOO	Indianapolis, Indiana 46250	RC - Rock	COring Drilling		BS	- Bag	Sam	ple	` F	Pi - Pi	asticity	Index	•
ENGIN	EERING #	Phone: 317-585-8277 Fax: 317-585-8621	WD - Was	h Drillir	ng	AC	- Aug			5	SPT - St Pe	andaro enetrat		st
<u> </u>		I AA. 317-303-0021	_n∧ •nan	u Muyel										

TEST BORING RECORD RB-15 BORING NO.: : Indiana Department of Transportation CLIENT SHEET OF : SR 15/US 20 Improvement **PROJECT** DATE STARTED : 05-16-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DATE COMPLETED: 05-16-01 DES NO. HAMMER : Automatic BORING METHOD: HSA BORING ELEVATION: 268.63 m (USC&GS) STATION 11+440 DRILLER : KO : CME 55 Truck RIG TYPE **OFFSET** C/L TEMPERATURE: 75° F : 83 mm CASING DIA. LINE "C" WEATHER : Sunny **CORE SIZE DEPTH** 5.33 m ∑ 24 hours Reading 1,22 m Caved in at 2.74 m At Completion Dry GROUNDWATER: Encountered at Dry Unconfined Compression (kN/m²) Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery Moisture Content (' Limits Stratum Elevation SPT/ 30 Sample Number SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Depth Ê LL PL Pl 0.15 TOPSOIL (152 mm) (Visual) 268.48 2 2 6 100 16 SS-1 Brown, with Gray Streaks, Moist, Medium Stiff, 4 SANDY CLAY LOAM with Traces of Roots As Lab 1 4 1.07 267.56 SS-2 4 12 100 8 5 100 **SS-3** 10 23 13 4 SS-4 10 23 100 3.0 Brown Changing to Gray, Moist to Slightly Moist, Very Stiff to Stiff, LOAM with Sand 13 Seams (TILL) A-4 As Lab 5 2 **SS-5** 5 100 11 6 6 SS-6 7 19 100 12 5.33 263.30_ Bottom of Boring at 5.33 meters Boring backfilled with soil cuttings. 6.0_ **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer SS - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Liquid Limit ST - Shelby Tube Sample LL SFA - Solid Flight Auger - Rock Core Sample PL - Plastic Limit Indianapolis, Indiana 46250 CR RC - Rock Coring - Bag Sample ΡI - Plasticity Index MD - Mud Drilling BS Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC - Auger Cuttings Penetration Test Fax: 317-585-8621 HA - Hand Auger

TEST BORING RECORD BORING NO.: RB-16 : Indiana Department of Transportation CLIENT OF __1 SHEET **PROJECT** : SR 15/US 20 Improvement DATE STARTED : 05-23-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-23-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic BORING METHOD: HSA BORING ELEVATION : 270.61 m (USC&GS) **STATION** : 11+570 DRILLER : KO **RIG TYPE** : CME 55 Truck **OFFSET** C/L TEMPERATURE: 75° F CASING DIA. : 83 mm LINE WEATHER : Sunny **CORE SIZE** 3.05 m **DEPTH** Caved in at 1.50 m At Completion 2.44 m GROUNDWATER: Encountered at 2.44 m Unconfined Compression (kN/m²) Atterberg 턍 SPT / 15cm Recovery (%) Total Unit Weight (kg/m³) Moisture Content (SPT/ 30 c (N) Limits Stratum Elevation Stratum Depth SOIL/MATERIAL DESCRIPTION Sample Number Sample Depth PL ΡI 0.15 TOPSOIL (152 mm) (Visual) 270.46 2 SS-1 2 6 67 26 4 Dark Gray Changing to Light Gray, Very Moist, Medium Stiff to Hard, SANDY CLAY LOAM 5 As Lab 1 36 SS-2 11 78 25 1.52 269.09 1.5 5 20 100 **SS-3** 10 10 Brown Changing to Gray, Moist, Very Stiff to Medium Stiff, LOAM As Lab 5 2 10 100 SS-4 4 6 267.56 3.0<u></u> 3.05 Bottom of Boring at 3.05 meters Boring backfilled with soil cuttings. 4.5 6.0 **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer HSA - Hollow Stem Auger SS - Split Spoon Sample 6330 East 75th Street, Suite 178 - Shelby Tube Sample - Liquid Limit LL ST SFA - Solid Flight Auger PL - Plastic Limit CR - Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring - Bag Sample - Plasticity Index ы MD - Mud Drilling ВŞ Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC - Auger Cuttings Penetration Test Fax: 317-585-8621 HA - Hand Auger

TEST BORING RECORD BORING NO.: **RB-17** CLIENT : Indiana Department of Transportation SHEET OF **PROJECT** : SR 15/US 20 Improvement : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County : 05-23-01 DATE STARTED LOCATION DATE COMPLETED: 05-23-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. HAMMER : Automatic BORING ELEVATION: 269.63 m (USC&GS) **BORING METHOD: HSA STATION** : 11+680 DRILLER : KO **RIG TYPE** : CME 55 Truck **OFFSET** C/L TEMPERATURE: 75° F CASING DIA. : 83 mm "C" LINE WEATHER : Sunny **CORE SIZE DEPTH** 4.57 m At Completion 3.20 m 24 hours Reading 1.22 m Caved in at 2.44 m GROUNDWATER: Encountered at 4.42 m Unconfined Compression (kN/m²) Molsture Content (%) Ë Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Stratum Elevation Limits SPT/30 SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth E LL PL ы 0.15 TOPSOIL (152 mm) (Visual) 269.48 2 Brown with Black Streaks, Slightly Moist, SS-1 3 6 89 Loose, SANDY LOAM 3 A-4 As Lab 3 0.76 268.87 4 SS-2 5 12 100 11 7 4 **SS-3** 4 10 100 6 Brown Changing to Gray, Slightly Moist to Moist, Medium Stiff to Stiff, LOAM (TILL) 2 As Lab 5 6 13 94 **SS-4** 3.0 2 4 **SS-5** 13 100 4.42 265.21 4.5 9 Brown, Wet, Medium Dense, SAND (Visual) 4.57 265.06 Bottom of Boring at 4.57 meters Boring backfilled with soil cuttings. 6.0 ABBREVIATIONS **BORING METHOD SAMPLING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer SS - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Shelby Tube Sample LL. - Liquid Limit SFA - Solid Flight Auger ST - Plastic Limit Indianapolis, Indiana 46250 - Rock Core Sample PL RC - Rock Coring CR - Bag Sample ΡI - Plasticity Index BS MD - Mud Drilling Phone: 317-585-8277 AC - Auger Cuttings SPT - Standard WD - Wash Drilling Penetration Test Fax: 317-585-8621

HA - Hand Auger

			TE	ST BORI	NG I	RECO	ORD		_						
CLIENT	г	· Indiana	Department of Transportation							BOF	RING NO).:	RB	-18	
PROJE			US 20 Improvement		-			_		SHE	EET	1	o	F	2
LOCAT			from 0.56 km S. to 3.10 km N. o	f US 20 in Elkha	rt Coun	ty				DAT	E STAR	TED	: 05-1	3-01	
DES N			0, Project No.: STP-4320 (3), C					-		DA1	E COM	PLETED	: 05-1	3-01	
			: 265.20 m (USC&GS)	BORING ME		: HSA				HAN	MER	:_ /	Automa	atic	
			11+800	_ _ RIG TYPE		: CME 5	5 Truc	k		DRI	LLER	: <u></u>	O		
		•	5 m Lt	CASING DIA	۸.	: 83 mm)			TEN	IPERAT	URE : 7	'0° F		
}	LINS		: 10.67 m	CORE SIZE		:				WE	ATHER	: 5	Sunny		
GROU	NDWAT	ER: ¥	Encountered at Dry 5	At Completion	Dry	Δ	24 hou	ırs Rea	ading	Dry			aved i	n at <u>7.</u> 5	<u>92 m</u>
Stratum Elevation	ple th		SOIL/MATERIAL DESCRIPT	ION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m²)	Unconfined Compression (kN/m²)		tterbe Limits	
Stra	Sample Depth					San	SPT	SP	Rec	ខ្លួន	Y Vet	58	LL	PL.	PI
265.07 ₋		PORTL	LT CONCRETE (127 mm) (Visua AND CEMENT CONCRETE (229		4										
204.64_		(Visual)			0.30	SS-1	4 3 6	9	100						
	1.5	Gray Ch Medium A-4 As Lab	nanging to Brown, Slightly Moist, Stiff, SANDY CLAY LOAM			SS-2	7 5 5	10	100						
262.76					2.44	SS-3	2 3 4	7	94	18					
	3.0					SS-4	2 2 2	4	100	19				2	
259.87	4.5		Very Moist, Soft to Medium Stiff vith Wet Sand Seams (TILL) 5		5.33	\$S-5	2 3 5	8	100						
	6.0	Brown,	Moist, Loose, SAND (Visual) Continued on next page			SS-6	2 3 4	7	78						
		CTL	Engineering of Indiana, Inc.	BORING				AMPLI						TIONS	
ENGINE	ERING #	India: Phon	East 75 th Street, Suite 178 napolis, Indiana 46250 e: 317-585-8621	HSA - Hollow SFA - Solid RC - Rock MD - Mud I WD - Wash	Flight A Coring Drilling Drilling	luger	ST CR BS	- Split - She - Roci - Bag - Aug	iby Tul k Core Samp	be Sar Samp le	mple LL ple Pl	Liqı - Pla - Pla PT - Sta	uid Lin stic Lii sticity ndard	mit Index	

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CLIEN	Т	: Indiana Department of Transportation					-		BOF	RING NO	-:	RB	<u>-18</u>	
PROJE	СТ	: SR 15/US 20 Improvement				ī	1	/- 	SHE	ET	2	_ 0	F	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	A 	tterbe Limits PL	rg i
wШ	ω Δ	Brown, Moist, Loose, SAND (Visual)		SU	<i>w</i> 2	, o,	0,	ш.	20			L	-	<u>'</u>
258.34_	7.5	Light Brown, Moist to Slightly Moist, Loose to Medium Dense, SAND A-1-6 As Lab 4		6.86	SS-7 SS-8	2 3 5 5 7	8	89 67						
254.53	10.5	Bottom of Boring at 10.67 meters Boring backfilled with soil cuttings and pavement restored with concrete patch.		10.67	SS-9	8 13 13	26	67						
	12.0													
		Indianapolis, Indiana 46250 Phone: 317-585-8277	BORING HSA - Hollor SFA - Solid RC - Rock MD - Mud ND - Wash HA - Hand	w Stem Flight A Coring Drilling Drilling	Auger Auger	SS ST CR BS	- Splir - She - Roc - Bag - Aug	Spoo lby Tu k Core Samp	n Sam be Sa e Sam ble	nple * mple Li ple P	- Hai - Liq L - Pla I - Pla PT - Sta	nd Pe uid Li stic L sticity indare	imit Index	net

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CLIENT		: Indiana	Department of Transpo	rtation								BOF	RING NO).:	RB-	19	
PROJE			US 20 Improvement							_		SHE	EET	1	0	 F	1
LOCAT			from 0.56 km S. to 3.10	km N of U	IS 20 in I	Flkhai	rt Coun	tv		_		DAT	TE STAR		 :_05-1		
DES N			0, Project No.: STP-432					·		-				PLETED			
				.0 (3), 011	BORIN			. HSA					MER		utoma		
BORIN		TION	: 266.00 m (USC&GS) : 11+920						E Truc	ı.			LLER	: <u>*</u>		200	
	OFF		: 4 m Rt		RIG TY			: <u>CME 5</u>		<u> </u>		.		_			
	LINE		: <u>"C"</u>		CASING			: <u>83 mm</u>	<u> </u>			1		URE : <u>7</u>			
<u> </u>	DEP		: 3.05 m		CORE			:					ATHER		unny		
GROU	TAWD	ER: ¥	Encountered at <u>Dry</u>		At Comp	eletion	Dry	— —	24 hou	ırs Rea	ading .	Dry		T <u>a</u> Ca	aved ii	1 at <u>2.</u>	<u>59 m</u>
Stratum Elevation	Sample Depth		SOIL/MATERIAL DE	SCRIPTION	N		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m²)	Unconfined Compression (kN/m²)		terbe Limits	
E St	Sa						200	ซีรี	S.	<u>0</u>	æ	žΰ	⊬≱ક	Ξŏ	LL	PL	PI
265.92 265.44 262.95	1.5	Brown, Stiff, LO A-4 As Lab	Slightly Moist, Medium S	TE (483 mi		2 A - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2	0.56 0.56	SS-1 SS-2 SS-3	6 5 5 4 5 8 7 12 12 4 8 10	10 13 24 18	100 94 67	12		0		PL .	
ENGINE	4.5	6330 India Phon	Engineering of Indian East 75 th Street, Suit napolis, Indiana 4625 ne: 317-585-8277 317-585-8621	te 178	HSA - SFA - RC - MD -	Hollo Solid Rock Mud I Wash	Flight A Coring Drilling Drilling	Auger Auger	SS ST CR BS AC	- Spli - She - Roo - Bag - Aug	Spoot by Tuk Core Samp	n Sam be Sa Sam ole	nple * mple Li ple P	- Har L - Liq L - Pla I - Pla PT - Sta	REVIA nd Per uid Lir stic Li sticity undard	netrom nit mit Index	neter

SR_15 00-5061.GPJ CTLMET.GDT

TEST BORING RECORD BORING NO.: RB-20 : Indiana Department of Transportation CLIENT SHEET OF . : SR 15/US 20 Improvement **PROJECT** DATE STARTED : 05-17-01 : SR 15 from 0.56 km S, to 3.10 km N, of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-17-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. BORING METHOD: HSA HAMMER : Automatic BORING ELEVATION: 261.10 m (USC&GS) : <u>12+</u>080 :_K0 **STATION** DRILLER **RIG TYPE** : CME 55 Truck OFFSET : <u>2 m L</u>t TEMPERATURE: 70° F : 83 mm CASING DIA. : <u>"C"</u> LINE : Sunny WEATHER **CORE SIZE** : 7.62 m DEPTH Caved in at 5.94 m At Completion Dry GROUNDWATER: Encountered at Dry Unconfined Compression (kN/m²) Moisture Content (%) Atterberg £ SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Limits ž Stratum Elevation SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth SPT LL PL Ы ASPHALT CONCRETE (102 mm) over CEMENT CONCRETE (127 mm) over 0.30 260.80 ASPHALT CONCRETE (76 mm) (Visual) Brown, Slightly Moist, Loose, SANDY LOAM 100 **SS-1** 4 7 A-4 3 As Lab 3 0.91 260.19 3 Brown, Slightly Moist, Medium Dense, SAND SS-2 9 18 100 (Visual) 9 1.5_ 1.68 259.42 1 15 **SS-3** 2 5 89 3 2 SS-4 3 7 100 Brown, Moist, Soft to Medium Stiff, SANDY 3.0_ **CLAY LOAM** As Lab 1 2 4.42 **SS-5** 3 7 94 256.68_ 4 Light Brown, Slightly Moist, Loose to Medium Dense, SAND A-1-b As Lab 4 3 SS-6 9 19 67 6.0 10 Continued on next page **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Liquid Limit - Shelby Tube Sample SFA - Solid Flight Auger - Plastic Limit PL CR - Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring Plasticity Index BS - Bag Sample MD - Mud Drilling Phone: 317-585-8277 AC - Auger Cuttings SPT - Standard WD - Wash Drilling Penetration Test Fax: 317-585-8621 HA - Hand Auger

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LIENT		Indiana Department of Transportation					-			RING NO		RB 0		
Stratum Zi Elevation CO	Sample La	SOIL/MATERIAL DESCRIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Welght (kg/m²)	Unconfined Compression (kN/m²) ∾	O	tterber Limits	rg
Stra	Sarr			Str	San	SP	SP	Re.	ပို့	Tot (kg	58	LL	PL	PI
53.48_	7.5_	Light Brown, Slightly Moist, Loose to Medium Dense, SAND A-1-b As Lab 4 Bottom of Boring at 7.62 meters Boring backfilled with soil cuttings and pavement restored with concrete patch.		7.62	SS-7	4 7 12	19	67						
	9.0													



Indianapolis, Indiana 46250

Phone: 317-585-8277 Fax: 317-585-8621

SFA - Solid Flight Auger

RC - Rock Coring MD - Mud Drilling WD - Wash Drilling HA - Hand Auger

ST - Shelby Tube Sample LL CR - Rock Core Sample PL - Liquid Limit PL - Plastic Limit

PI - Plasticity Index SPT - Standard BS - Bag Sample AC - Auger Cuttings Penetration Test

SR_15 00-5061,GPJ CTLMET.GDT

TEST BORING RECORD BORING NO.: **RB-21** CLIENT : Indiana Department of Transportation SHEET OF : SR 15/US 20 Improvement **PROJECT** LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 05-22-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DATE COMPLETED: 05-22-01 DES NO. HAMMER BORING ELEVATION: 257.60 m (USC&GS) BORING METHOD: HSA : Automatic **STATION** : 12+170 : CME 55 Truck DRILLER : KO **RIG TYPE OFFSET** 10 m Lt TEMPERATURE: 75° F CASING DIA. : 83 mm "C" LINE **WEATHER** : Sunny **CORE SIZE DEPTH** 7.62 m ☑ 24 hours Reading <u>Dry</u> ▼ At Completion Dry Caved in at 4.11 m **GROUNDWATER:** Encountered at 5.94 m Unconfined Compression (kN/m²) SPT/ 30 cm (N) Moisture Content (%) Atterberg SPT / 15cm Total Unit Weight (kg/m²) Recovery (%) Limits Stratum Depth Sample Number SOIL/MATERIAL DESCRIPTION Sample Depth LL PL ΡI 2 3 78 SS-1 1 2 Brown, Slightly Moist, Very Loose, SAND (Visual) 3 SS-2 2 67 2 1.52 256.08 5 SS-3 3 7 4 3 SS-4 3 67 5 2 Light Brown to Brown, Slightly Moist to Wet, Loose to Medium Dense, SAND A-1-b As Lab 4 Tried many attempts at SS-3 6 SS-5 6 13 67 2 SS-6 5 11 33 6.0 251.50 6 6.10 Continued on next page SAMPLING METHOD **ABBREVIATIONS BORING METHOD** CTL Engineering of Indiana, Inc. - Split Spoon Sample - Hand Penetrometer SS HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 SFA - Solid Flight Auger - Shelby Tube Sample - Liquid Limit ST LL - Plastic Limit Indianapolis, Indiana 46250 - Rock Core Sample PL RC - Rock Coring CR ΡI - Plasticity Index MD - Mud Drilling BŞ - Bag Sample Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC - Auger Cuttings Fax: 317-585-8621 Penetration Test - Hand Auger HA

		TES	BORII	NG I	RECC	ORD								
CLIEN	Г	: Indiana Department of Transportation					_		BOF	RING NO).:	RB	-21	
PROJE		: SR 15/US 20 Improvement						,	SHE	ET	2	0	F :	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	A	tterbe Limits	rg
Electr	Sai		····	Sta	Sa	R.	S	R.	žΰ	₽ ≥₹	ວັບ	ш	PL	PI
249.98_	7.5	Light Brown to Brown, Slightly Moist to Wet, Loose, SAND A-1-b As Lab 4 Bottom of Boring at 7.62 meters Boring backfilled with soil cuttings. Dozer used to pull drilling rig.		_7.62	SS-7	5 4 5	9	50						
	9.0_													
	10.5													
	12.0													
	13.5 _ _													
		CTL Engineering of Indiana, Inc.	BORING HSA - Hollo			SS	- Split						TIONS	
ENGINE	ERING	Indianapolis, Indiana 46250	SFA - Solid RC - Rock MD - Mud WD - Wasl	Flight A Coring Drilling	Auger	ST CR BS		lby Tu k Core Samp	be Sa Sam ble	mple L ple P	L - Liq L - Pla	uid Lir stic Li sticity	mit imit Index	

Phone: 317-585-8277 Fax: 317-585-8621

MD - Mud Drilling WD - Wash Drilling HA - Hand Auger

PI - Plasticity Index SPT - Standard Penetration Test

SR_15 00-5061.GPJ CTLMET.GDT

			Т	EST BOR	ING I	RECC	RD								
CLIENT	-	: Indiana	a Department of Transportation	1						BOF	RING NO	.:	RS-2	21A	
PROJE			US 20 Improvement					-		SHE	ET	1	01	F	1
LOCAT			from 0.56 km S. to 3.10 km N.	of US 20 in Elkh	art Coun	ty		_		DAT	E STAR	TED	: 05-2	4-01	
DES N			20, Project No.: STP-4320 (3),							DAT	E COMP	PLETED	: 05-2	4-01	
1			: 256.50 m (USC&GS)	BORING M		: <u>HA</u>				HAN	MER	: <u>-</u> -	<u>-</u>		
	STA	TION	: 12+200	RIG TYPE		:				DRI	LLER	: <u> </u>	(O		
	OFF LINE		: 10 m Lt : "C"	CASING DI	Α.	: 83 mm	_			TEN	IPERAT	URE : <u>7</u>	5° F		
	DEP		: 0.91 m	CORE SIZE	<u> </u>	:				WE	ATHER	<u>: S</u>	unny		
GROU	NDWAT		Encountered at 0.30 m	At Completion	n <u>0.30 ı</u>	<u>n</u>						麗 C	aved ir	1 at <u>0.3</u>	<u>30 m</u>
Stratum Elevation	Sample Depth		SOIL/MATERIAL DESCRIF	PTION	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)		terber Limits	
		TOPSO	PIL (305 mm) (Visual)		0.30	AC-1 AC-2			100 100						
256.20 <u>1</u> 255.74	₽ - - -	Dark G	ray to Gray, Slightly Moist, SAI (Visual)	NDY	0.76	AC-3 AC-4 AC-5			100 100 100	18					
255.59	_#	Brown, Bottom	Moist, SAND (Visual) of Boring at 0.91 meter		0.91	AC-6			100						
	1.5	surface	Due to very soft soil condition , RS-21A was performed in the RB-21 was supposed to be dril	e area											
	3.0										:		:		
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	4.5										j				
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	6.0_														
<u></u>	<u> </u>	<u> </u>		5000	NG METI	100	 _	AMPL	ING M	ETHO	<u> </u>	ARRI	REVIA	TIONS	<u> </u>
			Engineering of Indiana, In	UCA Hall			SS			n San		- Ha	nd Pe	netron	
	411		DEast 75 th Street, Suite 176	SFA - Soli	d Flight	Auger	ST	- She	lby Tu	ibe Sa	mple Li		uid Lir istic Li		
		,	anapolis, Indiana 46250		k Coring Drilling			- Roo			P	ı - Pla	sticity	Index	
ENGINE	ERING #		ne: 317-585-8277	WD - Wa	sh Orillin	g		- Aug			s	PT - Sta			n f
1		Fax:	317-585-8621	HA - Har	id Auger		<u> </u>					Pe	netrati	on re	SL

TEST BORING RECORD BORING NO.: **RB-22** CLIENT : Indiana Department of Transportation SHEET OF **PROJECT** : SR 15/US 20 Improvement DATE STARTED LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County : 05-23-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DATE COMPLETED: 05-23-01 DES NO. BORING ELEVATION: 260.00 m (USC&GS) **BORING METHOD: HSA** HAMMER : Automatic : 12+315 STATION **RIG TYPE** DRILLER : KO : CME 55 Truck C/L **OFFSET** CASING DIA. : 83 mm TEMPERATURE: 75° F "C" LINE WEATHER : Sunny **CORE SIZE DEPTH** 6.10 m At Completion 2.59 m 24 hours Reading 2.82 m E Caved in at 2.95 m GROUNDWATER: Encountered at 2.74 m Unconfined Compression (kN/m²) Moisture Content (%) Ę Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery Stratum Elevation SPT/ 30 (N) Limits SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number LŁ PL Ы 2 **SS-1** 2 100 2 2 **SS-2** 2 8 100 6 Brown, Slightly Moist to Moist, Very Loose to Medium Dense, SAND (Visual) Q SS-3 18 89 11 257.26 2 2.74 SS-4 2 6 89 3.0 Brown, Wet, Loose to Medium Dense, SAND 78 SS-5 6 13 A-1-b 4.5_ As Lab 4 11 SS-6 10 23 89 6.0 13 253.90 6.10 Bottom of Boring at 6.10 meters Boring backfilled with soil cuttings. SAMPLING METHOD **ABBREVIATIONS BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer HSA - Hollow Stem Auger SS - Split Spoon Sample 6330 East 75th Street, Suite 178 SFA - Solid Flight Auger - Shelby Tube Sample LL - Liquid Limit - Rock Core Sample Indianapolis, Indiana 46250 PL - Plastic Limit RC - Rock Coring CR - Bag Sample - Plasticity Index MD - Mud Drilling BS Phone: 317-585-8277 WD - Wash Drilling - Auger Cuttings SPT - Standard Fax: 317-585-8621 Penetration Test HA - Hand Auger

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CLIENT			Indiana	Department of Trans	sportation						_		BOF	RING NO).:	RB.	23	
PROJE				US 20 Improvement							_		SHE	EΤ	1	0	F	1
LOCAT				from 0.56 km S. to 3.	10 km N. of U	S 20 in	Elkha	rt Coun	ty				DAT	E STAR	RTED	: <u>05-1</u>	7-01	
DES NO				20, Project No.: STP-									DAT	E COM	PLETED	: 05-1	7-01	
				: 258.95 m (USC&G				THOD	: HSA				HAN	MER	:_ <i>F</i>	utoma	atic	
				12+440		RIG T	YPE		: CME 5	5 Truc	k		DRI	LLER	: <u></u>	O		
			SET	: <u>C/L</u>		CASIN	IG DIA		: 83 mm				TEN	IPERAT	URE: 7	0° F		
		NE EP:	ГН	: <u>"C"</u> : 3.05 m		CORE	SIZE		· —				WE	ATHER	: \$	Sunny		
GROU				Encountered at Dry	<u>A</u>			Dry	<u> 7</u>	24 hou	ırs Rea	dina	Dry	•		aved in	at 2.	59 m
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Stratum Elevation	Sample Depth			SOIL/MATERIAL	DESCRIPTION	N		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Molsture Content (%)	Total Unit Weight (kg/m ⁻)	Unconfined Compression (kN/m²)		terbei Limits	
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258.82		╽├		LT CONCRETE (127			\times	0.13										
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258.34_	_	IXI-				.		0.61	SS-1	8 5	13	78						
		Н	Brown,	Slightly Moist, Mediur SANDY LOAM	n Dense to V	ery												
		Ц	A-4															
257.73_	_	M	As Lab	<u> </u>			[]]]	1.22	\$S-2	3 2	4	72	İ		1			
	1.5_	M								2								
		П																
	_	Н	Brown t	o Light Gray, Slightly o Medium Dense, SA	Moist, Very ND (Visual)		:::			4								
		IXI.		·	· · · · · · · · · · · · · · · · · · ·				SS-3	6	12	78						
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256.51_	_	╽┝	0	Slightly Moist, Mediu	- CHE LOAM	 I	1111	2.44				1						
4	. –	И	(TILL)	Slightly Moist, Mediu	II Sun, LOAN)				2	l	١	١				40	_
	3.0	IXI	A-4 (1) Lab 5					3.05	SS-4	6	10	94	13			20	13	7
255.90_	J.J_	H		of Boring at 3.05 me	ters		1111	13.05		ľ						ŀ		
	-	$\ \ $	Boring I	backfilled with soil cut	tings and			Į				ļ						ļ
			paveme	ent patch restored wit	h concrete pa	tch.		1				ĺ						
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				Engineering of Ind				G METH w Stem		SS	- Spli					nd Per		
1	L ,	7		East 75 th Street, S		SFA	- Solid	Flight /	Auger	ST	- She	lby Tu	be Sa	mple L	L - Liq	uid Lir	nit	
		7		napolis, Indiana 46	3250			Coring Drilling		CR BS	- Roc			ple P		istic Li isticity		
ENGINE	ERING	¥		ne: 317-585-8277				h Drilling	g		- Aug				PT - Sta	ındard		
			Fax:	317-585-8621		HA	- Hand	i Auger			_				Pe	netrati	on Te	st

TEST BORING RECORD BORING NO.: CLIENT : Indiana Department of Transportation SHEET OF : SR 15/US 20 Improvement **PROJECT** DATE STARTED : 05-17-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-17-01 : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **BORING METHOD: HSA** HAMMER : Automatic BORING ELEVATION: 258.35 m (USC&GS) : **KO STATION** : 12+560 DRILLER **RIG TYPE** : CME 55 Truck : <u>4 m L</u>t **OFFSET** TEMPERATURE : 40° F : 83 mm CASING DIA. : "C" LINE **WEATHER** : Sunny **CORE SIZE DEPTH** 7.62 m At Completion Dry Caved in at <u>5.79 m</u> GROUNDWATER: Encountered at 5.94 m Unconfined Compression (kN/m²) Moisture Content (%) Atterberg Ë SPT / 15cm Total Unit Weight (kg/m²) Limits SPT/ 30 (N) Recovery Stratum Elevation SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth PL PΙ ASPHALT CONCRETE (305 mm) (Visual) 0.30 258.05 R 100 SS-1 10 26 16 9 13 100 SS-2 7 6 **SS-3** 4 9 100 6 7 100 **SS-4** 4 3 3.0 Brown, Slightly Moist Changing to Moist, Medium Dense to Loose, SAND (Visual) 6 **SS-5** 6 89 11 5 8 252.41¥6.0 12 24 94 **SS-6** 5.94 12 Continued on next page ABBREVIATIONS SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Liquid Limit - Shelby Tube Sample H SFA - Solid Flight Auger ST - Plastic Limit - Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring CR - Bag Sample - Plasticity Index BS MD - Mud Drilling Phone: 317-585-8277 SPT - Standard - Auger Cuttings WD - Wash Drilling Penetration Test Fax: 317-585-8621 HA - Hand Auger

		TEST E	30RI	NG I	RECO	ORD)	•					·	_
CLIEN	Г	: Indiana Department of Transportation					_		BO	RING NO	:	RB	-24_	
PROJE	СТ	: SR 15/US 20 Improvement							SHE	ET	2	_ 0	F	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	A	tterbe Limits	rg
Stra	Sar			St.	Sai	S.	g B	§.	≩ိပိ	5 ¥ ₹	58	LL	PL	PI
250.73_	7.5	Light Brown, Moist to Wet, Medium Dense, SAND A-1-b As Lab 4 Bottom of Boring at 7.62 meters		_7.62	SS-7	7 6 5	11	78			:			
	-	Boring backfilled with soil cuttings and pavement restored with concrete patch.												
	9.0													
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Indianapolis, Indiana 46250

Phone: 317-585-8277 Fax: 317-585-8621

SFA - Solid Flight Auger

RC - Rock Coring MD - Mud Drilling WD - Wash Drilling

HA - Hand Auger

ST - Shelby Tube Sample
CR - Rock Core Sample
BS - Bag Sample
AC - Auger Cuttings

LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
SPT - Standard Penetration Test

TEST BORING RECORD BORING NO.: **RB-25** : Indiana Department of Transportation CLIENT SHEET OF **PROJECT** : SR 15/US 20 Improvement DATE STARTED : 05-23-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-24-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. HAMMER : Automatic **BORING METHOD: HSA** BORING ELEVATION: 258.82 m (USC&GS) **STATION** : 12+680 **RIG TYPE** DRILLER : KO : CME 55 Truck **OFFSET** : <u>C/L</u> TEMPERATURE : 75° F CASING DIA. : 83 mm : <u>"C"</u> LINE : Sunny **CORE SIZE** WEATHER DEPTH : 10.67 m 24 hours Reading 5.79 m At Completion 6.40 m E Caved in at 6.40 m GROUNDWATER: Encountered at 7.47 m Unconfined Compression (kN/m²) Moisture Content (%) 퉌 Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Limits Stratum Elevation SPT/ 30 (N) SOIL/MATERIAL DESCRIPTION Sample Number Sample Depth LL PL ы ASPHALT CONCRETE (914 mm) (Visual) SS-1 0.91 257.91 3 SS-2 100 3 8 5 5 SS-3 3 6 100 3 6 3 100 SS-4 8 Brown, Slightly Moist, Loose to Medium Dense, SAND with Sandy Loam Layer @ 5.64 m to 5.94 m (Visual) 3 **SS-5** 3 8 94 8 67 SS-6 10 23 13 6.10 252.72 Continued on next page **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Shelby Tube Sample LL - Liquid Limit SFA - Solid Flight Auger ST - Plastic Limit PL Indianapolis, Indiana 46250 RC - Rock Coring CR - Rock Core Sample - Bag Sample - Plasticity Index BS MD - Mud Drilling Phone: 317-585-8277 - Auger Cuttings SPT - Standard WD - Wash Drilling Penetration Test Fax: 317-585-8621 HA - Hand Auger

	TEST B	ORII	NG F	RECC	RD								
CLIENT	: Indiana Department of Transportation					_		BOF	RING NO).:	RB	-25	
PROJECT	: SR 15/US 20 Improvement							SHE	ET	2	0	F	2
Stratum Elevation Sample Depth	SOIL/MATERIAL DESCRIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m²)	Unconfined Compression (kN/m²)	A	tterbe Limits	rg i
San Deg		Ţ.··	Str	Sar	S.	တ္တ	Re.	မိုပိ	_ \$ \ \$	58	ᄔ	PL	Pi
▼7.5_/	Brown, Slightly Moist to Wet, Loose to Medium			SS-7	5 4 5	9	78						
9.0	Dense, SAND (Visual)			SS-8	8 6 7	13	89						
10.5	Bottom of Boring at 10.67 meters Boring backfilled with soil cuttings and pavement restored with concrete patch.		_10.67	SS-9	4 5 7	12	78				*		
12.0													
FIGUREERING B	6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 RC	- Hollov - Solid - Rock - Mud [w Stem Flight A Coring	Auger	SS ST CR	AMPLI - Split - She - Roc - Bag	Spoo lby Tu k Core	n Sam be Sai Sami	nple ti	- Hai L - Liq L - Pla	nd Per uid Lir stic Li		nete

TEST BORING RECORD BORING NO.: CLIENT : Indiana Department of Transportation SHEET OF : SR 15/US 20 Improvement **PROJECT** : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 06-20-01 LOCATION DATE COMPLETED: 06-20-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. BORING METHOD: HSA HAMMER : Automatic BORING ELEVATION: 259.67 m (USC&GS) STATION 12+762 DRILLER : KO : CME 550 ATV **RIG TYPE OFFSET** 5 m Rt TEMPERATURE: 80° F CASING DIA. : 83 mm LINE "C" WEATHER : Sunny **CORE SIZE DEPTH** 12.19 m At Completion Dry △ Caved in at 7.01 m Encountered at 5.49 m GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) Atterberg Ê SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Limits Stratum Elevation SPT/ 30 (N) SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth PL ы TOPSOIL (64mm) (Visual) 0.06 259.61 Ö, **GRAVEL FILL** (Visual) 0 0.46 259,21 6 **SS-1** 100 6 16 10 11 SS-2 14 32 100 18 Brown, Slightly Moist to Moist, Dense to Very 8 Loose, SAND (Visual) 89 SS-3 8 14 6 2 **SS-4** 2 100 3.0 1 1 3.66 256.01 2 18 **SS-5** 2 5 100 Brown, Slightly Moist, Soft, SANDY CLAY 3 LOAM A-4 As Lab 1 5.64 254.03 8 **SS-6** 8 15 33 Light Brown to Brown, Wet, Medium Dense, 6.0 SAND (Visual) Continued on next page **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. HSA - Hollow Stem Auger - Hand Penetrometer - Split Spoon Sample 6330 East 75th Street, Suite 178 - Liquid Limit Shelby Tube Sample SFA - Solid Flight Auger - Plastic Limit PL Indianapolis, Indiana 46250 RC - Rock Coring CR - Rock Core Sample - Plasticity Index BS - Bag Sample MD - Mud Drilling Phone: 317-585-8277 AC - Auger Cuttings SPT - Standard WD - Wash Drilling Penetration Test Fax: 317-585-8621 HA - Hand Auger

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CLIENT		: Indiana Department of Transportation					-			RING NO		RB		
PROJE	CT	: SR 15/US 20 Improvement					1		SHE	<u> </u>		<u> </u>	Τ	2_
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	A	tterbe Limits	
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252.81_		Light Brown to Brown, Wet, Medium Dense, SAND (Visual)		6.86				!						
	7.5				SS-7	5 10 10	20	67	:					
	9.0\ - -	Brown, Wet, Medium Dense to Loose, SAND A-1-b As Lab 4			SS-8	3 4 5	9	67						
249.31_	10.5	Gray, Wet to Slightly Moist, Stiff to Very Stiff,		10.36	SS-9	5 6 8	14	89						
247.48 <u>.</u>	12.0_	LOAM (TILL) A-4 As Lab 5 Bottom of Boring at 12.19 meters Boring backfilled with soil cuttings.		12.19	SS-10	7 11 16	27	89						
	13.5_ -													
	ш Ц	CTL Engineering of Indiana, Inc.	BORIN				AMPL						TIONS	
ENGINE	ERING #	6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 Rhope: 317,585,8277	SA - Hollo FA - Solid C - Rock ID - Mud VD - Was	Flight A Coring Drilling	Auger	SS ST CR BS AC	- Spli - She - Roc - Bag - Aug	lby Tu k Core Sam	ibe Sa e Sam ple	mple L ple F	L - Liq L - Pla	juid Li astic L asticity	imit / Index	

TEST BORING RECORD BORING NO.: **RB-27** CLIENT : Indiana Department of Transportation SHEET OF : SR 15/US 20 Improvement PROJECT : SR 15 from 0.56 km S, to 3.10 km N, of US 20 in Elkhart County DATE STARTED : 05-15-01 LOCATION DATE COMPLETED: 05-15-01 : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. HAMMER : Automatic BORING ELEVATION: 271.96 m (USC&GS) BORING METHOD: HSA **STATION** : 12+900 DRILLER : KO **RIG TYPE** : CME 55 Truck **OFFSET** : C/L TEMPERATURE: 70° F CASING DIA. : 83 mm "C" LINE WEATHER : Sunny **CORE SIZE** 6.71 m DEPTH At Completion Dry GROUNDWATER: Encountered at Dry Caved in at 5.49 m Unconfined Compression (kN/m²) Moisture Content (%) 틍 Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery Limits Stratum Elevation SPT/ 30 Stratum Depth Sample Number SOIL/MATERIAL DESCRIPTION Sample Depth Ê LL PL ΡI 0.15 TOPSOIL (152 mm) (Visual) 271.81 2 SS-1 2 100 2 2 Brown, Slightly Moist, Very Loose, SAND 2 SS-2 78 (Visual) 2 1.5 2 1.98 269.98 SS-3 3 94 6 3 Brown, Slightly Moist, Loose to Very Loose, 1 SANDY LOAM **SS-4** 2 89 4 A-4 3.0 2 As Lab 3 3.66 268.30 Brown, Slightly Moist, Medium Stiff, LOAM 5 100 **SS-5** 10 5 As Lab 5 5 267.08 3 Light Brown, Slightly Moist, Loose, SAND SS-6 3 6 78 A-1-b 3 As Lab 4 6.0 Continued on next page ABBREVIATIONS SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 ST - Shelby Tube Sample - Liquid Limit SFA - Solid Flight Auger - Plastic Limit Indianapolis, Indiana 46250 CR - Rock Core Sample RC - Rock Coring - Plasticity Index MD - Mud Drilling BS - Bag Sample Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings WD - Wash Drilling Fax: 317-585-8621 Penetration Test HA - Hand Auger

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CLIEN	т	: Indiana Department of Transportation							BOF	RING NO).:	RB-	27	
PROJE		: SR 15/US 20 Improvement							SHE	ET	2	0	F	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	N	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	A LL	tterbe Limits PL	rg PI
SП	SO	Light Brown, Slightly Moist, Loose, SAND	<u> </u>	6,0		2 3			20	- (-		-	-
265.25	-X -	A-1-b As Lab 4 Bottom of Boring at 6.71 meters Boring backfilled with soil cuttings.		6.71	\$S-7	3 4	7	78						
	7.5													
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	13.5													
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		CTL Engineering of Indiana, Inc.	HSA - Hollo				- Split				- Ha	nd Pei	netron	
	77/	6330 East 75 th Street, Suite 178	SFA - Solid	Flight	Auger	ST	- She	lby Tu	be Sa	mple Li	L - Liq	uid Lir stic Li	nit	
12		Indianapolis, Indiana 46250	RC - Rock				- Roc - Bag			P	I - Pla	sticity	Index	
ENGINE	EERING L	Phone: 317-585-8277 Fax: 317-585-8621	WD - Wasi	h Drillin			- Aug			s	PT - Sta	indard netrati		

Fax: 317-585-8621 SR_15 00-5061.GPJ CTLMET.GDT

TEST BORING RECORD BORING NO.: **RB-28** CLIENT : Indiana Department of Transportation SHEET OF **PROJECT** : SR 15/US 20 Improvement : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 05-23-01 LOCATION DATE COMPLETED: 05-23-01 : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** BORING ELEVATION: 271.84 m (USC&GS) **BORING METHOD: HSA** : Automatic :_13+060 STATION DRILLER : KO **RIG TYPE** : CME 55 Truck OFFSET : C/L TEMPERATURE: 75° F CASING DIA. : 83 mm : <u>"C"</u> LINE WEATHER **CORE SIZE** : Sunny 7.62 m **DEPTH** ∑ 24 hours Reading Dry At Completion Dry GROUNDWATER: Encountered at Dry 型 Caved in at <u>6.71 m</u> Unconfined Compression (kN/m) SPT / 15cm Atterbera SPT/ 30 cm Total Unit Weight (kg/m²) Recovery (%) Moisture Content (' Stratum Elevation Limits Sample Number SOIL/MATERIAL DESCRIPTION LL ΡĹ ы ASPHALT CONCRETE (356mm) (Visual) 271.48 0.36 5 **SS-1** 5 8 100 Brown, Moist, Loose, SAND (Visual) 3 0.91 270.93 5 SS-2 10 13 4 56 6 1.5 3 SS-3 6 15 100 9 Brown, Slightly Moist, Medium Stiff to Very Stiff, SANDY CLAY LOAM 6 A-4 As Lab 1 **SS-4** 16 100 6 3.0 10 4 4.27 267.57 SS-5 8 17 89 9 Light Brown, Slightly Moist, Medium Dense, SAND (Visual) 5 5.79 266.05 Light Brown, Slightly Moist, Medium Dense, SS-6 5 12 94 6.0 SĂND 7 A-1-b As Lab 4 Continued on next page **ABBREVIATIONS SAMPLING METHOD BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer HSA - Hollow Stem Auger - Split Spoon Sample 6330 East 75th Street, Suite 178 LL - Liquid Limit ST - Shelby Tube Sample SFA - Solid Flight Auger Plastic Limit Indianapolis, Indiana 46250 CR - Rock Core Sample RC - Rock Coring - Plasticity Index MD - Mud Drilling BS - Bag Sample ы Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC - Auger Cuttings Fax: 317-585-8621 Penetration Test HA - Hand Auger

		TES)											
CLIEN	т	: Indiana Department of Transportation					_		BOF	RING NO	D.:	RB	-28	
PROJE		: SR 15/US 20 Improvement						_	SHE	ET	2	0	F	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Molsture Content (%)	Total Unit Weight (kg/m²)	Unconfined Compression (kN/m²)	Α	tterber Limits	rg
S S	Sa		- h. · . ·	Str	Sa	S	ß	Se .	≊ပိ	°¥.¥	50	LL	PL	PI
264.22 <u>.</u>	7.5	Light Brown, Slightly Moist, Medium Dense, SAND A-1-b As Lab 4 Bottom of the Boring at 7.62 meters Boring backfilled with soil cuttings and		_7.62	SS-7	3 9 12	21	89						
	9.0	pavement restored with concrete patch.												
ENGINE	3.5	Indianapolis, Indiana 46250 Phone: 317-585-8277	BORING HSA - Hollor SFA - Solid RC - Rock MD - Mud I WD - Wash HA - Hand	w Stem Flight A Coring Drilling Drilling	Auger Auger		- Split - She - Roc - Bag - Aug	Spoo lby Tu k Core Samp	n Sam be Sam Samp le	nple * mple L ple F	- Har L - Liq PL - Pla PI - Pla SPT - Sta	nd Pe uid Lit stic Li sticity indard	mit Index	eter

SR_15 00-5061.GPJ CTLMET.GDT

TEST BORING RECORD CLIENT BORING NO.: **RB-29** : Indiana Department of Transportation **PROJECT** : SR 15/US 20 Improvement SHEET OF LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 05-17-01 DES NO. 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DATE COMPLETED: 05-17-01 BORING ELEVATION: 265.15 m (USC&GS) BORING METHOD: HSA **HAMMER** : Automatic STATION : 13+200 DRILLER **RIG TYPE** : CME 55 Truck : KO **OFFSET** 4 m Rt CASING DIA. : 83 mm TEMPERATURE: 70° F "C" LINE **WEATHER CORE SIZE** : Sunny **DEPTH** 3.05 m At Completion Dry **GROUNDWATER:** Encountered at Dry **旦** Caved in at 2.51 m Unconfined Compression (kN/m²) Molsture Content (%) 틍 Atterberg SPT / 15cm Total Unit Weight (kg/m²) Recovery (%) SPT/ 30 (N) Limits Stratum Depth SOIL/MATERIAL DESCRIPTION Sample Depth LL PL ы ASPHALT CONCRETE (356 mm) (Visual) 0.36 264.79 9 **SS-1** 10 23 94 13 6 SS-2 4 6 100 2 Brown, Moist to Slightly Moist, Medium Dense to Very Loose, SAND (Visual) 3 SS-3 2 6 94 4 2 2 100 SS-4 4 3.0 2 3.05 262.10 Bottom of Boring at 3.05 meters Boring backfilled with soil cuttings and pavement restored with concrete patch. 4.5 6.0 **ABBREVIATIONS** SAMPLING METHOD BORING METHOD CTL Engineering of Indiana, Inc. HSA - Hollow Stem Auger - Split Spoon Sample - Hand Penetrometer 6330 East 75th Street, Suite 178 - Shelby Tube Sample LL - Liquid Limit SFA - Solid Flight Auger PL - Plastic Limit Indianapolis, Indiana 46250 RC - Rock Coring CR - Rock Core Sample - Bag Sample - Plasticity Index BS MD - Mud Drilling Phone: 317-585-8277 AC - Auger Cuttings SPT - Standard WD - Wash Drilling Fax: 317-585-8621 Penetration Test - Hand Auger

TEST BORING RECORD **RB-30** BORING NO.: CLIENT : Indiana Department of Transportation SHEET OF **PROJECT** : SR 15/US 20 Improvement DATE STARTED : 05-17-01 LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE COMPLETED: 05-17-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic BORING METHOD : HSA BORING ELEVATION: 259.90 m (USC&GS) 13+360 STATION DRILLER : KO **RIG TYPE** : CME 55 Truck **OFFSET** 4 m Rt TEMPERATURE: 70° F CASING DIA. : 83 mm "C" LINE WEATHER : Sunny **CORE SIZE** 2.29 m DEPTH At Completion 1,42 m □ 24 hours Reading 1.22 m Daved in at 1.40 m Encountered at 1.37 m **GROUNDWATER:** Unconfined Compression (kN/m²) Moisture Content (%) Atterberg SPT / 15cm Recovery (%) Total Unit Weight (kg/m²) Stratum Elevation SPT/ 30 c (N) Limits **SOIL/MATERIAL DESCRIPTION** Stratum Depth Sample Depth LL PL ы ASPHALT CONCRETE (356 mm) (Visual) 0.36 259.54 6 SS-1 5 8 89 3 Gray, Moist, Loose, SAND to SAND LOAM (Visual) 2 4 78 **SS-2** 11 1.37 258.53 7 Brown, Wet, Medium Dense, SAND A-1-b 6 As Lab 4 SS-3 12 23 89 11 2.29 257.61 Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings and pavement restored with concrete patch. 3.0 4.5_ 6.0 **ABBREVIATIONS BORING METHOD SAMPLING METHOD** CTL Engineering of Indiana, Inc. - Split Spoon Sample - Hand Penetrometer HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Liquid Limit LL ST Shelby Tube Sample SFA - Solid Flight Auger PL- Plastic Limit Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring ÇR - Plasticity Index BS Bag Sample MD - Mud Drilling Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings - Wash Drilling WD Penetration Test Fax: 317-585-8621 - Hand Auger HΑ

TEST BORING RECORD BORING NO.: **RB-31** CLIENT : Indiana Department of Transportation SHEET 1 OF : SR 15/US 20 Improvement **PROJECT** : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 05-17-01 LOCATION DATE COMPLETED: 05-17-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. HAMMER : Automatic BORING ELEVATION: 256.00 m (USC&GS) BORING METHOD: HSA **STATION** : 13+520 DRILLER : KO **RIG TYPE** : CME 55 Truck **OFFSET** 4 m Lt TEMPERATURE: 70° F CASING DIA. : 83 mm "C" LINE **WEATHER** : Sunny **CORE SIZE** 2.29 m **DEPTH** At Completion Dry Caved in at 1.76 m GROUNDWATER: Encountered at 1.98 m Unconfined Compression (kN/m²) SPT/ 30 cm (N) Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Moisture Content (* Stratum Elevation Limits SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth ш PL ы ASPHALT CONCRETE (406 mm) (Visual) 0.41 255.59 6 SS-1 3 94 6 3 3 Dark Brown to Brown, Moist to Wet, Loose to SS-2 3 4 67 Very Loose, SAND A-1-b 1 As Lab 4 5 9 **SS-3** 100 10 1 2.29 253.71 Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings and pavement restored with concrete patch. 3.0 4.5 6.0 **ABBREVIATIONS SAMPLING METHOD BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer HSA - Hollow Stem Auger SS - Split Spoon Sample 6330 East 75th Street, Suite 178 - Shelby Tube Sample LL - Liquid Limit SFA - Solid Flight Auger - Plastic Limit Indianapolis, Indiana 46250 RC - Rock Coring CR - Rock Core Sample PL - Bag Sample Р١ Plasticity Index MD - Mud Drilling BS Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC - Auger Cuttings Fax: 317-585-8621 Penetration Test HA - Hand Auger

TEST BORING RECORD CLIENT : Indiana Department of Transportation BORING NO.: **RB-32** PROJECT : SR 15/US 20 Improvement SHEET OF LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 05-17-01 DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DATE COMPLETED: 05-17-01 **BORING METHOD: HSA** BORING ELEVATION: 265.40 m (USC&GS) **HAMMER** : Automatic **STATION** : 5+100 **RIG TYPE** : CME 55 Truck DRILLER : KO **OFFSET** : 6 m Lt CASING DIA. : 83 mm TEMPERATURE: 70° F LINE : S-US20-B **DEPTH** : 2.29 m **CORE SIZE** WEATHER : Rain At Completion Dry GROUNDWATER: Encountered at Dry Caved in at 1.65 m Unconfined Compression (kN/m²) Moisture Content (%) Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Stratum Elevation SPT/ 30 c Limits SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Depth Sample Number £ LL PL М ASPHALT CONCRETE (51 mm) over PORTLAND CEMENT CONCRÉTE(152mm) 265.10 0.30 over BASE (102 mm) (Visual) 3 **SS-1** 2 78 16 2 Brown, Moist, Soft to Medium Stiff, SANDY 2 **CLAY LOAM** SS-2 2 4 94 20 A-4 2 As Lab 1 3 **SS-3** 100 3 7 2.29 263.11 Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings and pavement restored with concrete patch. 3.0 4.5 6.0 **BORING METHOD ABBREVIATIONS** SAMPLING METHOD CTL Engineering of Indiana, Inc. HSA - Hollow Stem Auger - Split Spoon Sample - Hand Penetrometer 6330 East 75th Street, Suite 178 SFA - Solid Flight Auger ST - Shelby Tube Sample LL - Liquid Limit Indianapolis, Indiana 46250 RC - Rock Coring - Rock Core Sample PL - Plastic Limit CR - Bag Sample MD - Mud Drilling ы - Plasticity Index BS Phone: 317-585-8277 WD - Wash Drilling AC - Auger Cuttings SPT - Standard Fax: 317-585-8621 Penetration Test - Hand Auger HA

TEST BORING RECORD CLIENT BORING NO.: **RB-33** : Indiana Department of Transportation **PROJECT** : SR 15/US 20 Improvement SHEET OF LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 05-17-01 : 8354420, Project No.: STP-4320 (3), CTŁ No.: 00-050061 DES NO. DATE COMPLETED: 05-17-01 BORING METHOD: HSA BORING ELEVATION: 263.70 m (USC&GS) HAMMER : Automatic STATION 5+240 **RIG TYPE** : CME 55 Truck DRILLER : KO **OFFSET** 6 m Rt CASING DIA. TEMPERATURE: 70° F : 83 mm LINE S-US20-B DEPTH 2.29 m **CORE SIZE WEATHER** : Rain ▼ Encountered at 1.78 m At Completion 1.78 m GROUNDWATER: ∑ 24 hours Reading 1.27 m Caved in at 1.68 m Unconfined Compression (kN/m²) 틍 Atterberg SPT / 15cm Total Unit Weight (kg/m²) Recovery (%) Moisture Content (Stratum Elevation Limits SPT/ 30 (N) SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth LL PL Ы ASPHALT CONCRETE (76 mm) over PORTLAND CEMENT CONCRÉTE (305 mm) 0.38 263.32 (Visual) 5 SS-1 4 8 100 Gray, Moist, Loose, SAND (POSSIBLE FILL) 4 (Visual) 262.79 0.91 Gray with Brown Streaks, Moist, Medium Stiff, 2 **SANDY CLAY LOAM SS-2** 3 100 8 18 A-4 1.5 5 As Lab 1 1.68 262.02 Brown, Slightly Moist, Stiff, LOAM 5 A-4 **SS-3** 6 100 14 As Lab 5 8 261.41 2.29 Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings and pavement restored with concrete patch. 3.0 4.5 6.0 **BORING METHOD** SAMPLING METHOD **ABBREVIATIONS** CTL Engineering of Indiana, Inc. HSA - Hollow Stem Auger - Split Spoon Sample - Hand Penetrometer 6330 East 75th Street, Suite 178 SFA - Solid Flight Auger - Shelby Tube Sample LL - Liquid Limit Indianapolis, Indiana 46250 RC - Rock Coring - Rock Core Sample PL - Plastic Limit CR MD - Mud Drilling - Bag Sample - Plasticity Index BS Phone: 317-585-8277 WD - Wash Drilling AC - Auger Cuttings SPT - Standard Fax: 317-585-8621 Penetration Test HΑ Hand Auger

TEST BORING RECORD : Indiana Department of Transportation BORING NO.: **RB-34** CLIENT SHEET OF 1 **PROJECT** : SR 15/US 20 Improvement : <u>05-1</u>7-01 **DATE STARTED** LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE COMPLETED: 05-17-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic BORING METHOD: HSA BORING ELEVATION: 265.40 m (USC&GS) **STATION** 5+375 DRILLER : KO RIG TYPE : CME 55 Truck **OFFSET** : 13 m Lt TEMPERATURE: 70° F CASING DIA. : 83 mm LINE : S-US20-B CORE SIZE WEATHER : Rain : 2.29 m **DEPTH** At Completion Dry Encountered at Dry Caved in at 1.65 m **GROUNDWATER:** Unconfined Compression (kN/m²) Moisture Content (%) Atterberg SPT / 15cm Total Unit Weight (kg/m²) Recovery (%) Stratum Elevation SPT/ 30 (N) Limits SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth LL PL Ы Dark Brown to Dark Gray, Slightly Moist, Medium Dense, SAND with Little Gravel (FILL) 5 (Visual) 8 **SS-1** 12 67 0.61 264.79 4 9 Gray and Brown Changing to Brown, Slightly Moist to Moist, Very Stiff, SANDY CLAY **SS-2** 12 78 26 14 LOAM A-4 As Lab 1 9 **SS-3** 9 19 67 2.29 10 263.11 Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings. 3.0 6.0 SAMPLING METHOD ABBREVIATIONS BORING METHOD CTL Engineering of Indiana, Inc. HSA - Hollow Stem Auger SS - Split Spoon Sample - Hand Penetrometer 6330 East 75th Street, Suite 178 - Shelby Tube Sample - Liquid Limit SFA - Solid Flight Auger ST LL RC - Rock Coring Indianapolis, Indiana 46250 CR - Rock Core Sample PL - Plastic Limit - Plasticity Index М MD - Mud Drilling BS - Bag Sample Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings WD - Wash Drilling Fax: 317-585-8621 Penetration Test - Hand Auger HA

TEST BORING RECORD CLIENT : Indiana Department of Transportation BORING NO.: : SR 15/US 20 Improvement SHEET OF **PROJECT** SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE STARTED : 05-17-01 DATE COMPLETED: 05-17-01 DES NO. 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 **BORING METHOD: HSA** HAMMER BORING ELEVATION: 263.95 m (USC&GS) : Automatic **STATION** 5+480 **RIG TYPE** : CME 55 Truck DRILLER : KO **OFFSET** : 7 m Rt TEMPERATURE: 70° F CASING DIA. : 83 mm LINE : S-US20-B **CORE SIZE WEATHER** : Rain DEPTH : 2.29 m Encountered at 1.83 m GROUNDWATER: Caved in at 1.60 m Unconfined Compression (kN/m²) Atterberg SPT / 15cm Total Unit Weight (kg/m²) Recovery (%) Moisture Content (Stratum Elevation SPT/ 30 c (N) Limits SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth LL PL Pł ο. GRAVEL BASE (381 mm) (Visual) 0 0.38 263.57 10 SS-1 4 94 14 10 2 Dark Brown Changing to Brown, Moist to Wet, Medium Dense to Very Loose, SAND (Visual) 2 **SS-2** 4 78 2 .5 SS-3 3 94 6 3 261.66 2.29 Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings. 3.0 6.0 ABBREVIATIONS SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Split Spoon Sample - Hand Penetrometer HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 SFA - Solid Flight Auger ST - Shelby Tube Sample LL - Liquid Limit Indianapolis, Indiana 46250 - Rock Core Sample - Plastic Limit RC - Rock Coring CR PL - Bag Sample - Plasticity Index - Mud Drilling BS ы MD Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC - Auger Cuttings Fax: 317-585-8621 Penetration Test - Hand Auger HA

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CLIEN	Т	: Indiana Department of Transportation								ВО	RING NO) .:	RB-	-36			
PROJECT : SR 15/US 20 Improvement							_		SHE				F	1			
LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co						ty		_		DAT	E STAF	RTED	 : 05-1	7-01			
DES NO. : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061								DATE COMPLETED: 05-17-01									
BORIN				: HSA			HAMMER : Automatic										
STATION : 5+620			RIG TYPE : CME 55 Tr			55 Truc	k		DRI	LLER	- : H	(0					
OFFSE LINE			CASIN	G DIA	DIA. : <u>83</u>		: 83 mm			TEN	IPERAT	URE : 70° F					
DEPTH : 2.29 m		CORE SIZE			:			WE	ATHER	R : Rain							
GROU	NDWATI	ER; ▼ Encountered at Dry ▼	At Comp	eletion	Dry	Δ	24 ho	urs Rea	ading	<u>0.99 n</u>	1		aved in	at <u>1.</u>	<u>68 m</u>		
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTIO	Stratum Depth			Sample Number	SPT / 15cm SPT/ 30 cm (N)		Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m²)	Unconfined Compression (kN/m²)	Atterberg Limits				
N E	ÖĞ	ACDUALT CONCRETE (51 mm) Over		~~	ωď	ΰŽ	S	S	ă.	ΣÚ	<u> </u>	בֿט ב	LL	PL	PI		
261.39 <u> </u>		ASPHALT CONCRETE (51 mm) over PORTLAND CEMENT CONCRETE (102 m over ASPHALT CONCRETE (51 mm) over SASE (203 mm) (Visual)	im)		_0.41	SS-1	4 3 5	8	94	23		-					
1	1.5\ 1.5\ 2	Gray and Brown Changing to Brown, Mois Slightly Moist, Soft to Very Stiff, SANDY C LOAM A-4 As Lab 1	t to LAY			SS-2	2 3 2	5	83								
259.51_	-{				2.29	SS-3	7 9	16	100								
		Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings and															
	3.0	pavement restored with concrete patch. NOTE: The 24-hours groundwater reading															
		may be due to rain accumulated in the boand/or seepage water trapped in the base course.	rehole														
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	6.0												ı				
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	CTL Engineering of Indiana, Inc. BORING METH							AMPLI				ABBREVIATIONS - Hand Penetrometer					
		6330 East 75 th Street, Suite 178	HSA - I			•		SplitShell			ן פוע		id Pene uid Lim		eter		
	IL	Indianapolis, Indiana 46250	RC -	Rock	Coring	J	CR	- Rock	Core	Samp	le Pl	PL - Plastic Limit					
ENGINE	ERING	Phone: 317-585-8277	MD - 1			İ		• • •			Pi Si	Plas - T - Star	sticity ! ndard	лаех			
				WD - Wash Drilling AC - HA - Hand Auger								Penetration Test					

TEST BORING RECORD **RB-37** BORING NO.: CLIENT : Indiana Department of Transportation SHEET OF **PROJECT** : SR 15/US 20 Improvement DATE STARTED : 05-14-01 LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DATE COMPLETED: 05-14-01 DES NO. **HAMMER** : Automatic BORING METHOD: HSA BORING ELEVATION: 261.60 m (USC&GS) STATION 5+020 DRILLER : KO **RIG TYPE** : CME 55 Truck **OFFSET** 1 m Rt TEMPERATURE: 70° F CASING DIA. : 83 mm LINE S-1-B : Sunny WEATHER **CORE SIZE** DEPTH 3.05 m At Completion Dry ☑ 24 hours Reading Dry Encountered at Dry Caved in at 2.36 m GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) Atterberg SPT/ 30 cm SPT / 15cm Total Unit Weight (kg/m²) Recovery (%) Limits Stratum Elevation SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth LL PL Ρŀ ASPHALT CONCRETE (178 mm) over GRAVEL BASE (76 mm) over SAND BASE 0.33 261.27 (76 mm) (Visual) 4 **SS-1** 6 12 89 6 2 SS-2 2 3 100 1 Dark Brown Changing to Brown, Moist, Medium Dense to Very Loose, SAND (Visual) 2 2 SS-3 5 100 3 2 2 SS-4 3 100 3.0 3.05 1 258.55 Bottom of Boring at 3.05 meters Boring backfilled with soil cuttings and pavement restored with concrete patch. 4.5 6.0_ ABBREVIATIONS **BORING METHOD** SAMPLING METHOD CTL Engineering of Indiana, Inc. - Split Spoon Sample - Hand Penetrometer HSA - Hollow Stem Auger SS 6330 East 75th Street, Suite 178 - Liquid Limit - Shelby Tube Sample LL ST SFA - Solid Flight Auger - Plastic Limit Indianapolis, Indiana 46250 CR - Rock Core Sample PL - Rock Coring RC - Plasticity Index - Mud Drilling BS Bag Sample MD Phone: 317-585-8277 SPT - Standard WD - Wash Drilling AC **Auger Cuttings** Fax: 317-585-8621 Penetration Test - Hand Auger

TEST BORING RECORD BORING NO.: **RB-38** CLIENT : Indiana Department of Transportation SHEET OF **PROJECT** : SR 15/US 20 Improvement : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 05-15-01 LOCATION DATE COMPLETED: 05-15-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. BORING ELEVATION: 271.15 m (USC&GS) **BORING METHOD: HSA** HAMMER : Automatic STATION : 5+060 DRILLER : KO **RIG TYPE** : CME 55 Truck **OFFSET** 2 m Rt TEMPERATURE: 70° F CASING DIA. : 83 mm LINE : S-2-B WEATHER : Sunny **CORE SIZE DEPTH** : 7.62 m At Completion Dry Caved in at 6.02 m Encountered at Dry GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) Atterberg Ê Total Unit Welght (kg/m²) SPT / 15cm Recovery (%) Limits Stratum Elevation SPT/ 30 (N) Stratum Depth SOIL/MATERIAL DESCRIPTION Sample Number Sample Depth LL PL ы ASPHALT CONCRETE (102 mm) over BASE (152 mm) (Visual) 0.30 270.85 9 100 **SS-1** 5 11 6 Brown, Moist, Medium Dense to Very Loose, SAND (Visual) 2 SS-2 2 100 4 2 269.47 1.68 Brown, Moist, Medium Stiff, SANDY CLAY 3 LOAM SS-3 2 100 20 6 A-4 4 As Lab 1 2.44 268.71 2 **SS-4** 1 3 89 3.0 2 Brown, Moist, Very Loose to Medium Dense, SAND (Visual) 5 **SS-5** 10 23 78 13 5.33 265.82 Light Brown, Slightly Moist, Medium Dense, 4 SAND **SS-6** 10 25 89 A-1-b 15 As Lab 4 Continued on next page **BORING METHOD** SAMPLING METHOD ABBREVIATIONS CTL Engineering of Indiana, Inc. - Hand Penetrometer HSA - Hollow Stem Auger SS - Split Spoon Sample 6330 East 75th Street, Suite 178 - Liquid Limit SFA - Solid Flight Auger - Shelby Tube Sample - Plastic Limit Indianapolis, Indiana 46250 RC - Rock Coring CR - Rock Core Sample PL ы - Plasticity Index MD - Mud Drilling BS - Bag Sample Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings WD - Wash Drilling Fax: 317-585-8621 Penetration Test HA - Hand Auger

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CLIEN	Т	: Indiana Department of Transportation	<u> </u>				_		BOF	RING NO	.:	RB	-38			
PROJE	СТ	: SR 15/US 20 Improvement					1		SHE	ET_	2	0	F	2		
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Atterberg Limits				
Str	Sar			Str	Sa	g	R.	Re	¥ိပိ	PXX	58	ц	PL	PI		
263.53_	7.5	Light Brown, Slightly Moist, Medium Dense, SAND A-1-b As Lab 4 Bottom of Boring at 7.62 meters Boring backfilled with soil cuttings and pavement restored with concrete patch.		_7.62	SS-7	3 7 10	17	78								
	9.0															
	0.5															
	12.0_															
	13.5 <u> </u>															
		CTL Engineering of Indiana, Inc.	BORING				AMPLI - Split					- Hand Penetromete				
/A	71	6330 East 75 Street, Suite 178						by Tul	be Sar	nple LL						



Phone: 317-585-8277 Fax: 317-585-8621

MD - Mud Drilling WD - Wash Drilling HA - Hand Auger

BS - Bag Sample AC - Auger Cuttings

PI - Plasticity Index SPT - Standard

Penetration Test

SR_15 00-5061.GPJ CTLMET.GDT

TEST BORING RECORD **RB-39** BORING NO.: CLIENT : Indiana Department of Transportation SHEET OF : SR 15/US 20 Improvement **PROJECT** DATE STARTED : 05-14-01 : SR 15 from 0.56 km S, to 3.10 km N, of US 20 in Elkhart County LOCATION 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DATE COMPLETED: 05-14-01 DES NO. BORING ELEVATION: 259.85 m (USC&GS) BORING METHOD: HSA **HAMMER** : Automatic STATION 5+100 DRILLER : **KO RIG TYPE** : CME 55 Truck OFFSET 2 m Rt TEMPERATURE: 70° F CASING DIA. : 83 mm LINE S-3-B **CORE SIZE** WEATHER : Sunny 2.29 m DEPTH At Completion Dry Caved in at 1.09 m Encountered at Dry GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) Ê Atterberg SPT / 15cm Total Unit Weight (kg/m²) Limits Recovery Stratum Elevation SPT/ 30 (N) SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth ΡI LL PL ASPHALT CONCRETE (127 mm) over BASE 0.25 259.60 COURSE (127 mm) (Visual) 3 **SS-1** 7 100 Brown to Dark Gray, Slightly Moist, Loose, 4 SAND (Visual) 3 258.94 0.91 2 **SS-2** 2 7 89 24 Brown with Gray Streaks, Moist, Medium Stiff 5 to Stiff, SANDY CLAY LOAM As Lab 1 2 89 **SS-3** 4 12 8 257.56 **XXX 2.29** Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings and pavement restored with concrete patch. 3.0 4.5 6.0 **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Split Spoon Sample - Hand Penetrometer HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 LL - Liquid Limit SFA - Solid Flight Auger - Shelby Tube Sample PL. - Plastic Limit Indianapolis, Indiana 46250 RC - Rock Coring CR - Rock Core Sample - Plasticity Index BS MD - Mud Drilling - Bag Sample Phone: 317-585-8277 WD - Wash Drilling SPT - Standard AC - Auger Cuttings Fax: 317-585-8621 Penetration Test HA - Hand Auger

TEST BORING RECORD BORING NO.: **RB-40** CLIENT : Indiana Department of Transportation SHEET OF : SR 15/US 20 Improvement **PROJECT** : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED : 06-21-01 LOCATION DATE COMPLETED: 06-21-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic BORING ELEVATION: 269.95 m (USC&GS) **BORING METHOD: HSA** 1+040 STATION DRILLER : KO **RIG TYPE** : CME 55 Truck **OFFSET** C/L TEMPERATURE: 75° F CASING DIA. : 83 mm "H" LINE **CORE SIZE** WEATHER : Sunny **DEPTH** 7.01 m ▼ At Completion 4.88 m Caved in at 5.79 m Encountered at 4.27 m GROUNDWATER: Unconfined Compression (kN/m²) Molsture Content (%) SPT/ 30 cm Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Stratum Elevation Limits SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth Ê LL PL ы 2 **SS-1** 5 12 94 Brown and Gray, Slightly Moist, Stiff to Very 7 Stiff, SANDY CLAY LOAM with Little Roots As Lab 1 6 SS-2 12 26 100 1.07 268.88 14 5 **SS-3** 14 32 100 18 Brown, Moist, Medium Dense to Dense, SAND with Silt (Visual) 14 100 17 33 **SS-4** 3.0 16 3.66 266.29 7 Brown Changing to Gray, Moist, Very Stiff, 100 SS-5 7 17 LOAM (TILL) with Wet Sand Seams @ 4.27 m 10 to 2.42 m A-4 As Lab 5 5.33 264.62 Light Brown, Wet, Medium Dense to Dense, 7 SAND 100 SS-6 14 30 A-1-b 6.0 16 As Lab 4 Continued on next page **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. Split Spoon Sample - Hand Penetrometer HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Liquid Limit SFA - Solid Flight Auger Shelby Tube Sample ST Indianapolis, Indiana 46250 RC - Rock Coring CR - Rock Core Sample - Plastic Limit Р١ - Plasticity Index BS - Bag Sample MD - Mud Drilling Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings WD - Wash Drilling Fax: 317-585-8621 HA Hand Auger Penetration Test

		TEST	BORI	NG	RECO	ORD	l							_	
CLIEN	т	: Indiana Department of Transportation			<u></u> _		_		воя	RING NO	.:	RB	-40_		
		: SR 15/US 20 Improvement								SHEET			2 OF 2		
Stratum Elevation Sample Depth		SOIL/MATERIAL DESCRIPTION			Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m²)	Unconfined Compression (kN/m²)	Atterberg Limits			
क्ष	Sa		1	Stratum Depth	ΰŹ	<u>~</u>	S	œ	ΣŬ	¥₹₹	ΞŬ	ш	PL	PI	
262.94_	 - 	Light Brown, Wet, Medium Dense to Dense, SAND A-1-b As Lab 4 Bottom of Boring at 7.01 meters		7.01	SS-7	7 14 18	32	100							
	7.5_	Boring backfilled with soil cuttings.													
	-														
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	9.0							-							
					 			ļ	1						
	10.5														
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			9000		100		ABERL	NO 15	ETUC		APP	EVUV	TIONS		
	77/	CTL Engineering of Indiana, Inc. 6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 BORING HSA - Hollow SFA - Solid F RC - Rock C			Auger Auger	ST - Shelby Tube Sample					ABBREVIATIONS - Hand Penetrometer L - Liquid Limit L - Plastic Limit				

ENGINEERING #

Phone: 317-585-8277 Fax: 317-585-8621

MD - Mud Drilling WD - Wash Drilling HA - Hand Auger

BS - Bag Sample AC - Auger Cuttings

PI - Plasticity Index SPT - Standard Penetration Test

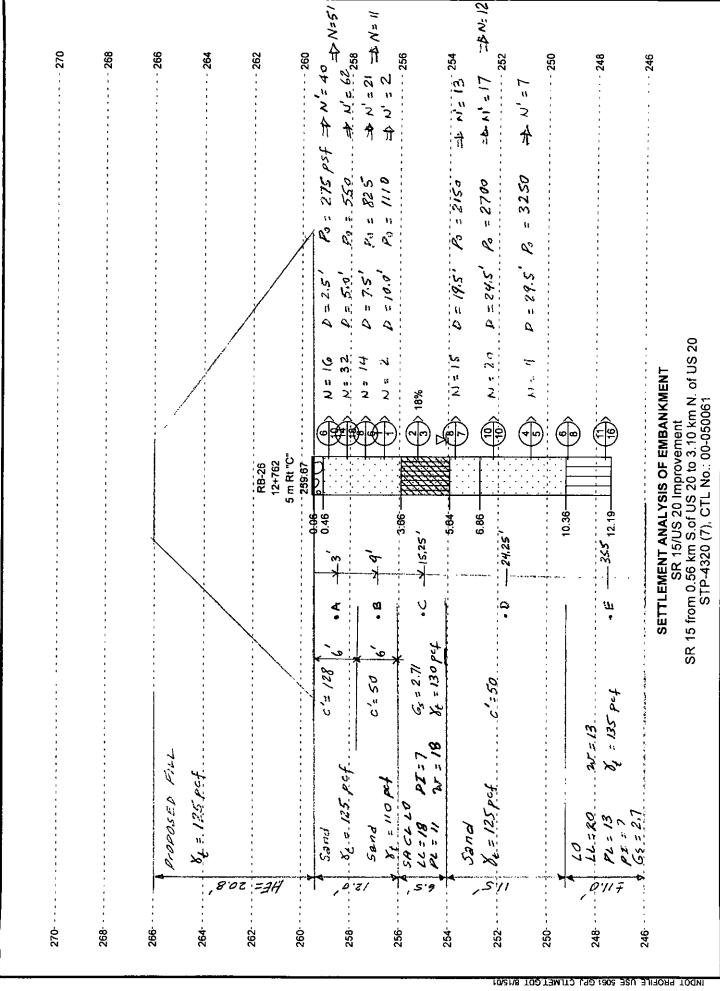
SR_15 00-5061.GPJ CTLMET.GDT

TEST BORING RECORD BORING NO.: **TB-1** CLIENT : Indiana Department of Transportation SHEET OF : SR 15/US 20 Improvement **PROJECT** : 05-22-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County DATE STARTED LOCATION DATE COMPLETED: 05-22-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. HAMMER : Automatic BORING ELEVATION: 257.65 m (USC&GS) BORING METHOD: HSA : KO STATION 10+128 DRILLER : CME 55 Truck RIG TYPE **OFFSET** 20 m Rt TEMPERATURE : 75° F CASING DIA. : 83 mm LINE "C" **WEATHER** : Sunny CORE SIZE 4.57 m DEPTH 24 hours Reading 1.83 m At Completion 1.83 m Caved in at 3,58 m Encountered at 1.68 m GROUNDWATER: Unconfined Compression (kN/m²) SPT/ 30 cm Atterberg SPT / 15cm Total Unit Weight (kg/m³) Moisture Content (Limits Recovery Stratum Elevation Stratum Depth SOIL/MATERIAL DESCRIPTION Sample Number Sample Depth 3 ы LL PL TOPSOIL (457 mm) (Visual) 0.46 257.19 2 3 94 28 SS-1 2 Black to Dark Gray, Moist, Very Loose, 1 **SANDY LOAM** 0 2 67 SS-2 1 As Lab 3 1 1.52 256.13_ Black to Dark Gray, Moist, Loose, SAND 4 A-1-b As Lab 4 1.98 SS-3 5 9 67 255.67 4 4 67 **SS-4** 5 11 6 3.0 Brownish Gray, Wet, Medium Dense, SAND (Visual) 5 SS-5 8 21 89 13 4.57 253.08 Bottom of Boring at 4.57 meters Boring backfilled with soil cuttings. Dozer used to pull drilling rig. 6.0 **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer SS - Split Spoon Sample HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 LL - Liquid Limit ST - Shelby Tube Sample SFA - Solid Flight Auger - Plastic Limit PL Indianapolis, Indiana 46250 RC - Rock Coring CR - Rock Core Sample - Bag Sample - Plasticity Index MD - Mud Drilling BS Phone: 317-585-8277 WD - Wash Drilling SPT - Standard AC - Auger Cuttings Penetration_Test Fax: 317-585-8621 - Hand Auger

TEST BORING RECORD BORING NO.: **TB-2** : Indiana Department of Transportation CLIENT SHEET OF **PROJECT** : SR 15/US 20 Improvement : 05-11-01 DATE STARTED : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-11-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **HAMMER** : Automatic BORING ELEVATION: 257.00 m (USC&GS) BORING METHOD: HSA STATION 10+126.5 DRILLER : KO : CME 55 Truck **RIG TYPE OFFSET** 20 m Lt TEMPERATURE: 70° F CASING DIA. : 83 mm "C" LINE WEATHER : Sunny **CORE SIZE DEPTH** 6.10 m At Completion 1.52 m 24 hours Reading 0.91 m **国** Caved in at 1.22 m Encountered at 1.83 m GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) 틍 Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery Stratum Elevation Limits SPT/ 30 (N) SOIL/MATERIAL DESCRIPTION Sample Number Sample Depth Stratum Depth LL PL Ы 3 TOPSOIL (305 mm) (Visual) 2 **SS-1** 4 67 21 0.46 256.54 2 Dark Gray to Black, Moist, Very Loose, SAND with Little Roots (Visual) 0.76 256.24 8 SS-2 31 72 24 7 6 12 72 **SS-3** 6 6 8 SS-4 10 18 89 3.0 8 Brownish Gray, Wet, Dense to Loose, SAND with Bouldery Zone at 1.52 m (Visual) 25 gallons of water was used to keep sand from heaving at 4.57 m 3 **SS-5** 4 9 83 5 8 **SS-6** 3 8 100 6.0_ 5 6.10 250.90 Bottom of Boring at 6.10 meters Continued on next page **BORING METHOD** SAMPLING METHOD **ABBREVIATIONS** CTL Engineering of Indiana, Inc. - Split Spoon Sample - Hand Penetrometer HSA - Hollow Stem Auger SS 6330 East 75th Street, Suite 178 - Shelby Tube Sample - Liquid Limit SFA - Solid Flight Auger ST - Plastic Limit PL Indianapolis, Indiana 46250 CR - Rock Core Sample RC - Rock Coring - Plasticity Index Bag Sample MD - Mud Drilling BS Phone: 317-585-8277 SPT - Standard - Auger Cuttings AC WD - Wash Drilling Fax: 317-585-8621 Penetration Test - Hand Auger HA

		TES	ST BO	ORI	NG	REC	ORD)	- "	•					
CLIEN	Т	: Indiana Department of Transportation						_		BO	RING NO	D.:	TE	3-2	
PROJE	ECT	SR 15/US 20 Improvement				_				SHE	ET	2	О)F	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTIO	N		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	Α	Atterbe Limits	s ¯
क्र म	တီဝိ	D. C. L. et Client Man . No. 18			200	ΰŹ	S	S	ď	Σŏ	⊬≥ ≥	. 5 ŭ	LL	PL	PI
S III	7.5	Boring backfilled with soil cuttings.			90	Ø.Z.	σ	S	α	NO CONTRACTOR OF THE PROPERTY				PL	P
							<u>L.</u> .								<u> </u>
		CTL Engineering of Indiana, Inc.			METH			MPLI				ABBR			
1	L _/ _	6330 East 75 th Street, Suite 178	HSA - SFA -					- Split - Sheli						ietrom nit	етег
	TL,	Indianapolis, Indiana 46250	RC -	Rock	Coring		CR	- Rock	Core	Samp	le Pl	- Plas	stic Lir	mit	
ENGINE	ERING #	Phone: 317-585-8277	MD - WD -		Drilling Drilling	ı		- Bag - Auge			PI	- Plas PT - Star		Index	
		Fax: 317-585-8621	HA -					, luge	Juli	93	3			on Tes	it

<u> </u>				TEST	BOR	ING	RECC	RD								
CLIENT	г	: Indiana	a Department of Transporta	tion					_		BOF	RING NO).:	ТВ	-3	
PROJE		_	US 20 Improvement	_							SHE	ET	1	0	F	1
LOCAT			from 0.56 km S. to 3.10 km	N. of US	20 in Elkh	art Coun	ty				DAT	E STAR	TED	05-2	2-01	
DES NO			20, Project No.: STP-4320 (DAT	Е СОМ	PLETED	: 05-2	2-01	
			: 258.15 m (USC&GS)	1	ORING M		: HSA				HAN	MER	:_ A	utoma	atic	
	STA	TION	: 12+636	R	IG TYPE		: CME 5	5 Truc	k		DRII	LLER	:_ K	0		
	OFF LINE		: 18 m Rt : "C"	c	ASING D	IA.	: <u>83 mm</u>			_	TEN	IPERAT	URE : _7	5° F		
ļ	DEP		: 4.57 m	<u>c</u>	ORE SIZE	<u> </u>	: —		,		WE	ATHER	:_S	unny		
GROU	NDWATI	ER: 🔻	Encountered at Dry	<u>√</u> At	Completion	on <u>Dry</u>	$\bar{\Delta}$	24 hou	ırs Rea	ading	Dry			aved in	n at <u>4.</u>	<u>27 m</u>
Stratum Elevation	Sample Depth		SOIL/MATERIAL DESC	RIPTION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m.)	Unconfined Compression (kN/m²)		tterbei Limits	
캶	S a				· · ·	<u> សីດ</u>	ซีรี_	, s	<u>N</u>	č	≅ŏ	મ્≽સ	ວັບ	LL	PL	PI
		Dark G Little Tr	ray, Moist, Very Loose, SAI aces of Roots (Visual)	ND with			\$S-1	2 1 1	2	67						
256.93_	-	<u> </u>				1.22	SS-2	2 2 4	6	56	1					
	1.5						SS-3	3 2 2	4	67						
	3.0_ <u>/</u>	SANDY	Moist to Very Moist, Loose CLAY LOAM between 1.96 (Visual)	e, SAND wil 8 m and	th		SS-4	3 3 2	5	89						
253.58 _.	4.5	B	n of Boring at 4.57 meters			4.57	SS-5	2 2 3	5	89			1			
	-	i	backfilled with soil cuttings.													
	6.0										ETUC		ADD	DEVA	TIONS	
1			Engineering of Indiana,		BORI HSA - Ho	NG MET		SS	AMPL - Spli		n San				netron	
	44		DEast 75th Street, Suite	1/8	SFA - Sol	id Flight	Auger	ST	- She	lby Tu	be Sa	mple L		uid Lir		
		/	anapolis, Indiana 46250	i i		ck Coring d Drilling		CR BS	- Roo			ple P		istic Li isticity	ımıt İndex	
ENGINE	ERING #		ne: 317-585-8277	V	ND - Wa	sh Drillin	g	AC	- Aug				PT - Sta	andard	l	
l		Fax:	317-585-8621	H	HA - Ha	nd Auger	•	1					<u>Pe</u>	netrati	ion Te	st



10/2

SETTLEMENT ANALYSIS OF EMBANKMENT

SR 15 / US 20 Improvement Project No.: STP - 4320 (7) CTL Project No.: 00-050061

Refer to attached Page 152

At C:

LI = (w-PL)/PI = (18-11)/7 =

1.000 Normally Consolidated

. .

 $e_o = (Gs * w) / 100 = (2.71*18) / 100 0.488$

 $C_c = w / 100 = 18 / 100 =$

0.180

At E:

LI = (w-PL)/PI = (13-13) / 7 =

0.000 Preconsolidated

 $e_o = (Gs * w) / 100 = (2.70*13) / 100 0.351$

 $C_r = w / 1000 = 18 / 1000 =$

0.013

Proposed Embankment:

Fill Height =

20.8 feet

Fill Unit Wt. =

125 pcf

Equations to calculate settlement:

 $\Delta H = H [1/C'] log [(P_o + P)/P_o)]$

Sand

 $\Delta H = H [C_c/(1/e_o)] log [(P_o + P)/P_o)]$

Clay

Normally Consolidated

 $\Delta H = H [C_r/(1/e_o)] log [(P_o + P)/P_o)]$

Clay

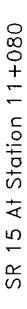
Preconsolidated

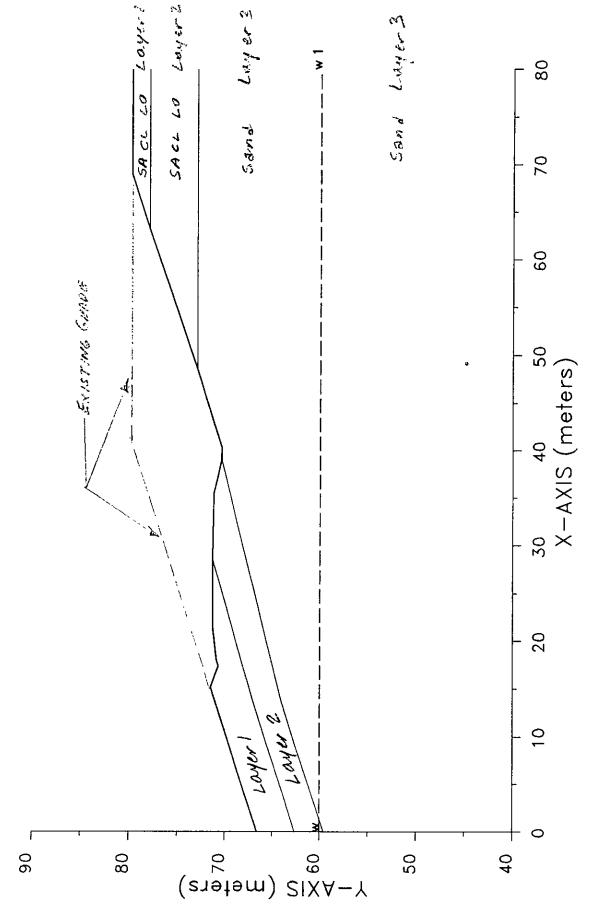
	Material	Layer	Unit		Cc		P _o	ΔP	Р	Δ	Н	
Point	Туре	Thicknes	Weight	C,	or	e _o	(psf)	(psf)	(psf)	(incl	nes)	
		H (feet)	(pcf)		C_{r}					Sand	Clay	
Ā	Sand	6.0	125	128			375	2600	375	0.5		
В	Sand	6.0	110	50			1080	2600	1080	0.8		
С	SA CL LO	6.5	130		0.180	0.488	1833	2600	1833		3.6	
D	Sand	11.5	125	50			2974	2600	2974	8.0		
Е	Loam	11.0	135		0.013	0.351	4435	2600	4435		0.3	
	TOTAL ESTIMATED SETTLEMENT											

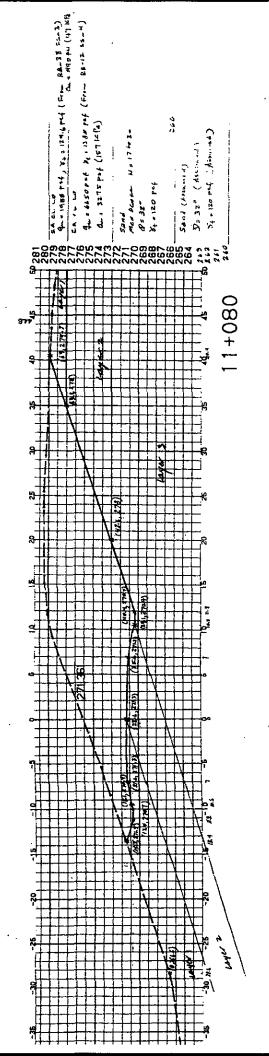


APPENDIX F SLOPE STABILTY ANALYSIS









			Thintakia	SCALE	BRIDGE FILE
			IIIDIANA	1:100	
			INTRADABLENT OF TRANSPORTATION	3NC)	DESIGNATION
			MOLINATION OF THAINS OF THE	C	8354420
-	DECORETY	. servou		SURVEY BOOK	SHEETS
			פועטושיטשט סטטסט	6478	10 1
	- Contract	O.C.O.C.D.	CNOTOGO CECANO	CONTRACT	PROJECT
					STP-4320(3)

```
PROFIL
                                               FILE: 61_3 8-17-01 9:23
SR 15 At Station 11+080
    18
            12
                  66.6
                            15.2
17.4
18.1
                               15.2
     .0
                                            71.5
                                                    1
                  71.5
     15.2
                               17.4
                                            70.7
                                                    1
     17.4
                  70.7
                                            70.9
                                                    1
                  70.9
     18.1
                             21.6
                                            71.3
     21.6
                  71.3
                               28.6
                                            71.3
                                                    1
     28.6
                  71.3
                                                    2
                               35.6
                                            71.2
     35.6
                  71.2
                               39.1
                                            70.4
                                                    3
     39.1
                  70.4
                               40.4
                                            70.4
                                                    3
     40.4
                  70.4
                               48.6
                                                    3
                                            73.0
     48.6
                73.0
78.0
                                                    3
                               63.3
                                            78.0
     63.3
                             69.0
                                           79.8
                                                    1
                79.8
     69.0
                               80.0
                                            79.8
                                                    1
                          13.6
28.6
80.0
13.6
39.1
80.0
              62.6
67.0
78.0
                                                    2
     . 0
                                            67.0
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SOIL
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    24.0
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    21.7
    25.6
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    18.9
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WATER
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80.0
RANDOM
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    10.0 40.0 30.0
.0 10.0 .0
                                          80.0
```

.0

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XSTABL File: 61_3 8-17-01 9:23

Problem Description : SR 15 At Station 11+080

SEGMENT BOUNDARY COORDINATES

12 SURFACE boundary segments

Segment	x-left	y-left	x-right	y-right	Soil Unit
No.	(m)	(m)	(m)	(m)	Below Segment
1 2 3 4 5 6 7 8	.0 15.2 17.4 18.1 21.6 28.6 35.6 39.1	66.6 71.5 70.7 70.9 71.3 71.3 71.2	15.2 17.4 18.1 21.6 28.6 35.6 39.1 40.4	71.5 70.7 70.9 71.3 71.3 71.2 70.4	1 1 1 1 2 3 3
9	40.4	70.4	48.6	73.0	3
10	48.6	73.0	63.3	78.0	3
11	63.3	78.0	69.0	79.8	1
12	69.0	79.8	80.0	79.8	1

6 SUBSURFACE boundary segments

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)	Soil Unit Below Segment
1	.0	62.6	13.6	67.0	2
2	13.6	67.0	28.6	71.3	2
3	63.3	78.0	80.0	78.0	2
4	. 0	59.6	13.6	64.0	3
5	13.6	64.0	39.1	70.4	3
6	48.6	73.0	80.0	73.0	3

ISOTROPIC Soil Parameters

3 Soil unit(s) specified

Soil Unit No.	Moist	šat.	Cohesion Intercept (kPa)		Pore Pr Parameter Ru		Water Surface No.
1	20.4	24.0 25.6	47.0 157.0	.00	.000	.0	1 1
3	18.9	20.8	.0	32.00	.000	.0	1

1 Water surface(s) have been specified

Unit weight of water = 9.81 (kN/m3)

Water Surface No. 1 specified by 2 coordinate points

PHREATIC SURFACE,

Point No.	x-water (m)	y-water (m)
1	.00	60.00
2	80.00	60.00

A critical failure surface searching method, using a random technique for generating IRREGULAR surfaces has been specified.

100 trial surfaces will be generated and analyzed.

10 Surfaces initiate from each of 10 points equally spaced along the ground surface between x = 10.0 m

and x = 40.0 m

Each surface terminates between x = 30.0 m

and x = 80.0 m

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 0.0 m

10.0 m line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

The 10 most critical of all the failure surfaces examined are displayed below - the most critical first

Failure surface No. 1 specified by 4 coordinate points

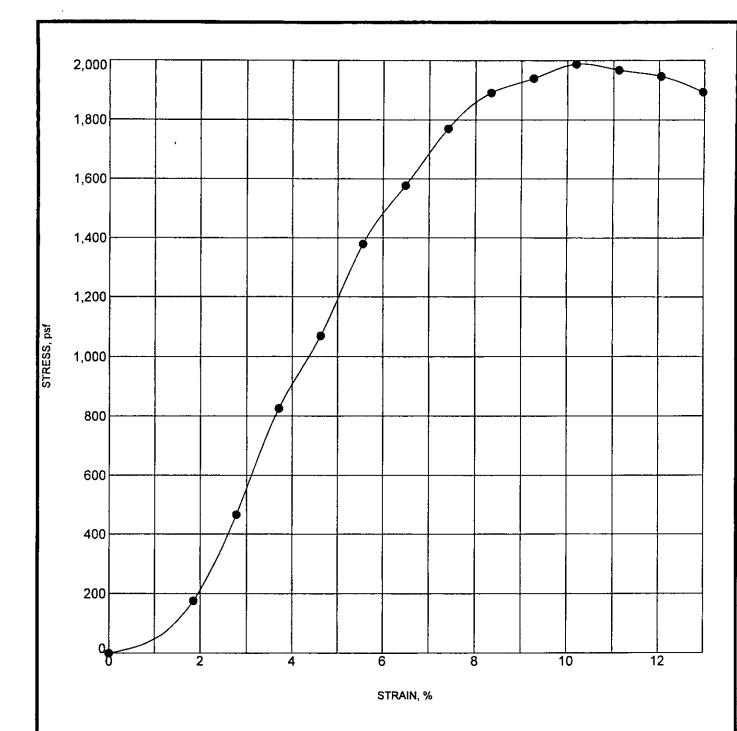
Point	x-surf	y-surf
No.	(m)	(m)
1	36.67	70.96
2	46.14	67.75
3	55.92	69.83
4	61.83	77.50

** Corrected JANBU FOS = 2.479 ** (Fo factor = 1.048)

The following is a summary of the TEN most critical surfaces

Problem Description : SR 15 At Station 11+080

	Modified JANBU FOS	Correction Factor	Initial x-coord (m)	Terminal x-coord (m)	Available Strength (kN)
1.	2.479	1.048	36.67	61.83	1.021E+03
2.	2.759	1.053	36.67	61.59	1.432E+03
3.	3.710	1.073	36.67	78.77	4.446E+03
4.	3.725	1.085	36.67	77.83	5.401E+03
5.	4.022	1.049	36.67	79.04	3.437E+03
6.	4.027	1.065	40.00	71.70	2.389E+03
7.	4.063	1.086	33.33	73.91	5.282E+03
8.	4.084	1.064	40.00	74.19	3.058E+03
9.	4.095	1.084	36.67	78.72	5.518E+03
10.	4.210	1.084	40.00	76.29	4.700E+03
		* * * END C	OF FILE * *	* *	



Boring In	formation	Test Results		
Boring No.	RB-38	Natural Moisture Content (%)	20	
Sample	SS-3	Natural Wet Density, pcf (kg/m³)	129.6	(2076)
Depth (m)	1.83 - 2.29	Natural Dry Density, pcf (kg/m³)	108.0	(1730)
Station	5+060	Unconfined Compression Strength, psf (kN/m²)	1988	(95)
Offset	2 m Rt	Failure Strain (%)	10.2	
Line	\$-2-B			



CTL Engineering of Indiana, Inc. 6330 E. 75th Street, Suite 176 Indianapolis, 105 and 46250

Phone: 317-585-8277 Fax: 317-585-8621 e-mail: ctlin@ctleng.com

UNCONFINED COMPRESSION TEST

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20 $\,$

PROCTOR TEST RESULTS

CLIENT:

Indiana Department of Transportation

PROJECT:

SR 15 from 0.56 km S. of US 20 to

3.10 km N. of US 20 Elkhart County, Indiana

Sample ID:

BS-1, Bag Sample - RB-7

Station:

10+720

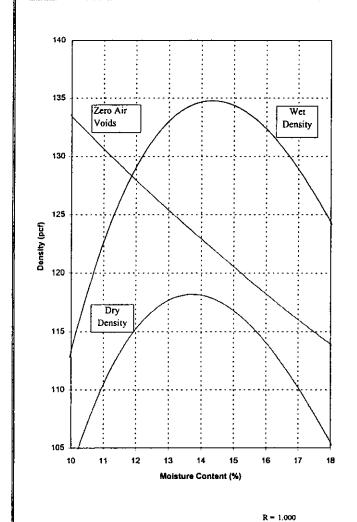
Offset:

5 m Rt, Line "C"

Depth:

0.15 m - 0.91 m

Classification: CLAY A-6 (7)



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Indianapolis, Indiana 46250

Phone: (317) 585 - 8277 Fax: (317) 585 - 8621

Project No.

00-050061

Lab Code No.

01-050762

Date Tested:

06/06/2001

Date Reported:

07/09/2001

Standard Proctor (AASHTO T 99)

Max. Dry Density (pcf)

118.2

Optimum Moisture (%)

13.7

Gradation (AASHTO T 88)

% Gravel

4.6

% Sand

28.3

% Silt % Clay 32.0 35.1

Atterberg Limits (ASTHMA T 89 & T 90)

Liquid Limit

29

Plastic Limit

14 Plasticity Index 15

Moisture Content (ASTM D2216)

Natural Wc (%) 15

Classification:(AASHTO M 145)

A-6 (7)

Specific Gravity (ASTM D 854)

SG

2.72

Reviewed by:



SUMMARY OF CBR TEST RESULTS

Client:

Indiana Department of Transportation

Project:

SR 15 from 0.56 km S. of US 20 to 3.10 km N. of US 20

Location:

Elkhart County

Project No:

00-050061

Sample No.:

Soil Description:

BS-1, Soil bag sample at a depth ranging from 0.5' to 3.0' (0.15 m - 0.91 m) at RB-7 CLAY A-6 (7)

Maximum Wet Density, pcf:

134.4

CBR @ 93% =

Maximum Dry Density, pcf:

118.2

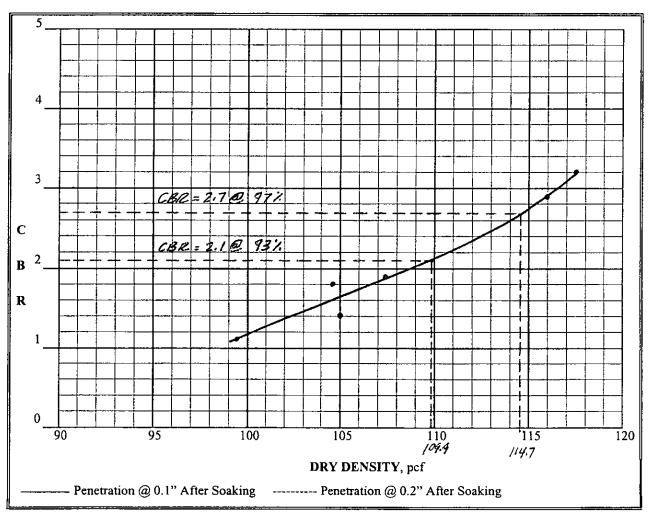
CBR @ 97% =

Optimum Moisture Content, %:

13.7

Surcharge Weight for Soaking, lbs: 25 (10 Kg)

Specimen	Blows Per		erage ontent (%)	Initial Dry Density	Percent Maximum	Swell		CBR	(%)	
No.14.5	Layer	As	After	(pcf)	Dry Density	(%)	Before S	aturation	After S	aturation
	Layer	Molded	Soaking	(22.)			0.1"	0.2"	0.1"	0.2"
1	15	15.0	19.4	104.8	88.6	0.8	7.1	6.4	1.8	1.8
2	15	13.2	19.2	99.4	84.1	1.2	7.3	6.9	1.1	0.9
3	30	13.3	20.4	105.0	88.8	1.5	9.1	8.6	1.4	1.4
4	30	13.0	20.8	107.4	90.9	2.0	11.1	10.1	1.9	1.9
5	65	13.4	19.2	117.5	99.4	1.2	13.8	13.2	3.2	2.9
6	51	12.7	19.8	116.0	98.1	2.0	19.1	17.2	2.9	2.6





Boring No.	Station	Offset	Line	Sample No.	Depth	Moisture Content (%)		Dry Density (pcf)	Unconfined Compression (psf)	Failure Strain (%)	Loss on Ignition (%)	pН
RB-10	11+020	20 m Lt	"C"	SS-1	0.15-0.61	14						
RB-10	11+020	20 m Lt	"C"	SS-3	1.68-2.13	14						
RB-10	11+020	20 m Lt	"C"	SS-5	4.11-4.57	14						8.29
RB-11	11+020	20 m Rt	"C"	SS-5	4.11-4.57	17	134.6	115.1	2651	9.3		
RB-12	11+080	30 m Rt	"C"	SS-3	1.68-2.13	14						•
RB-12	11+080	30 m Rt	"C"	SS-4	2.59-3.05	11	141.5	127.5	6552	16.7		
RB-12	11+080	30 m Rt	"C"	SS-5	4.11-4.57	12						
RB-12	11+080	30 m Rt	"C"	SS-8	8.69-9.14	5						8.87
RB-12	11+080	30 m Rt	"C"	SS-11	13.26-13.72	18						
RB-13	11+218	C/L	"C"	SS-3	1.68-2.13	18						
RB-13	11+218	C/L	"C"	SS-5	4.11-4.57	11						
RB-13	11+218	C/L	"C"	SS-6	5.64-6.10	10	·					
RB-14	11+320	3 m Rt	"C"	SS-2	1.07-1.52	18	-					
RB-14	11+320	3 m Rt	"C"	SS-4	2.59-3.05	19				-		
RB-15	11+440	C/L	"C"	SS-1	0.15-0.61	16						
RB-16	11+570	C/L	"C"	SS-1	0.15-0.61	26						•
RB-17	11+680	C/L	"C"	SS-2	0.91-1.37	11						
RB-18	11+800	5 m Lt	"C"	SS-3	1.83-2.29	18	141.6	120.0	1754	21.6		
RB-18	11+800	5 m Lt	"C"	SS-4	2.59-3.05	18						
RB-19	11+920	4 m Rt	"C"	SS-2	1.07-1.52	12			İ			
RB-2	10+000	3.5 m Lt	"C"	SS-3	1.83-2.29	18						
RB-20	12+080	2 m Lt	"C"	SS-3	1.83-2.29	15						
RB-23	12+440	C/L	"C"	SS-4	2.59-3.05	13						8.49
RB-26	12+762	5 m Rt	"C"	SS-5	4.11-4.57	18						
RB-28	13+060	C/L	"C"	SS-2	1.07-1.52	13						
RB-3	10+240	10 m Rt	"C"	SS-1	0.15-0.61	16		,				
RB-3	10+240	10 m Rt	"C"	SS-3	1.83-2.29	10						8.64
RB-32	5+100	6 m Lt S	-US20-	3 SS-1	0.30-0.76	16			Ì			
RB-32	5+100	6 m Lt S	-US20-	3 SS-2	1.07-1.52	20						
RB-33	5+240	6 m Rt S	-US20-	3 SS-2	1.07-1.52	18						
RB-36	5+620	7 m Lt S	-US20-	3 \$S-1	0.46-0.91	23						
RB-38	5+060	2 m Rt	S-2-B	SS-3	1.83-2.29	20	129.6	108.0	1988	10.2		
RB-39	5+100	2 m Rt	S-3-B	SS-2	1.07-1.52	34						
RB-4	10+360	10 m Rt	"C"	SS-1	0.15-0.61	15		ĺ				



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SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

Boring No.	Station	Offset	Line	Sample No.	Depth	Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Unconfined Compression (psf)	Failure Strain (%)	Loss on Ignition (%)	рН
RB-4	10+360	10 m Rt	"C"	SS-2	0.91-1.37	18						
RB-5	10+480	5 m Rt	"C"	\$S-1	0.46-0.91	13						
RB-5	10+480	5 m Rt	"C"	SS-2	1.07-1.52	11						-
RB-7	10+720	5 m Rt	"C"	SS-1	0.15-0.61	17						
RB-7	10+720	5 m Rt	"C"	BS-1	0.15-0.91	15						7.94
RB-7	10+720	5 m Rt	"C"	SS-2	0.91-1.37	13						
RB-7	10+720	5 m Rt	"C"	SS-5	4.11-4.57	19						
RB-8	10+840	C/L	"C"	SS-1	0.15-0.61	9						
RB-8	10+840	C/L	"C"	SS-4	2.59-3.05	15						
RB-9	10+960	C/L	"C"	SS-2	0.61-1.07	15						
RB-9	10+960	C/L	"C"	SS-4	1.83-2.29	19						
RS-21A	12+200	10 m Lt	"C"	AC-3	0.30-0.46	18						
TB-1	10+128	20 m Rt	"C"	SS-1	0.46-0.91	28	-					
TB-2	10+126.5	20 m Lt	"C"	SS-1B	0.30-0.61	21		:				

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SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project: SR 15/US 20 improvement

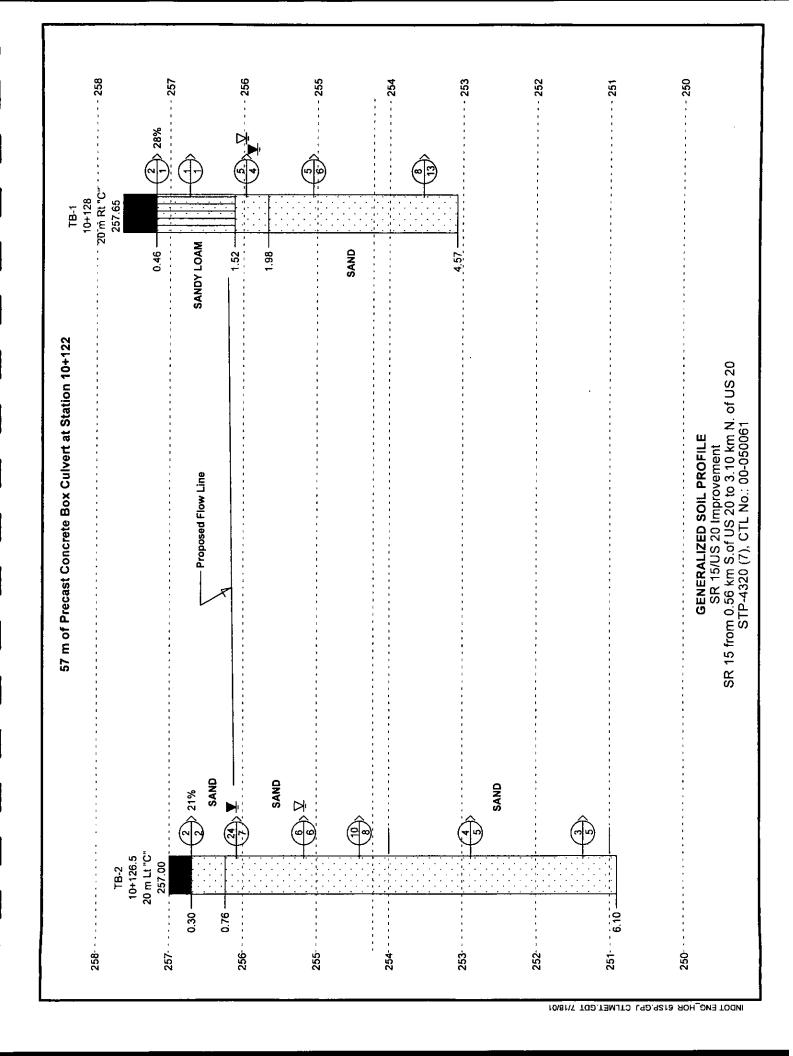
Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

APPENDIX D

GENERALIZED SUBSURFACE PROFILE ANALYSIS

For Box Culvert @ Station 10+122 For Pipe Culvert @ Station 12+630





FOUNDATION RECOMMENDATIONS

Structure No.: 3600mm x 1800mm x 57 m of Precast Concrete Box Culvert @ Station 10+122

Location: SR 15/US 20 Improvement

Project No.: <u>STP-4320 (3)</u>

Des. No.: <u>8354420</u>

CTL No.: 00-050061

DATA

1. Box Culvert 3600mm x 1800mm (12' x 6') to be placed at Station 10+122 with Flow Line @ Elev. 256.20 (downstream).

2. Assumed wingwalls placed on continuous footings at 4' (1.20 m) below flow line corresponding to elevations between 255.0. Wingwall footings will be placed on medium dense sand.

3. Surface water flowing through existing structure was observed during field investigation.

BOX CULVERT

1. The box culvert may be placed on existing soils provided that all loose sand are densified with a vibratory roller or removed and replaced with "B" Borrow or No. 53 aggregate to a minimum depth of 24 inches. The upper 24 inches should be compacted 100% of the maximum dry density.

2. Groundwater and surface water is expected during construction.

WINGWALLS

1. Footings are expected on medium dense sand with:

N = 11 & 18 bpf

Estimated $\phi = 30^{\circ}$, c = 0, $\gamma_t = 110$ pcf & $\gamma_{sub} = 110-62.4 = 47.6$ pcf

2. Water expected above footings (longterm)

3. Assume depth of footings, $D_f = At \pm 4$ ' below flow line, and

B = 2

B = 3

B = 4

B=5



Foundation Recommendations Box Culvert & Headwalls July 18, 2001, Revised August 15, 2001 Page 2

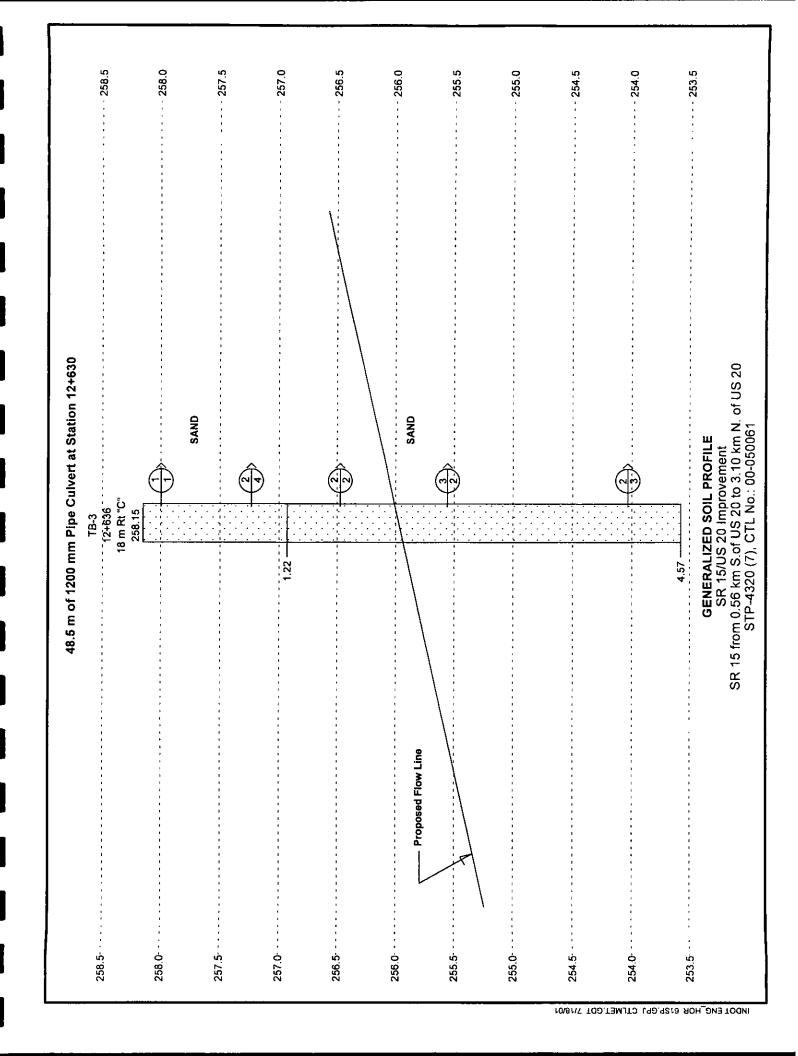
ALLOWABLE BEARING CAPACITY

Ultimate Bearing Capacity, q_{ult} =c N_c + $\gamma_{sub} D_f N_q$ + 0.5 $\gamma_{sub} B N_\gamma$ Allowable Bearing Capacity, q_{ult} = $(q_{ult} - \gamma_{sub} D_f) \div FS$

		N	NI	N.	De	В			FS			Recomm	ended q _{all}
Ψ_	C	N _c	N_q	1ηγ	$D_{\rm f}$	Б	γι	$\gamma_{ m sub}$	1 13	$\mathbf{q}_{ ext{ult}}$	$\mathbf{q}_{\mathtt{all}}$	psf	kPa
30	0	30.14	18.40	22.40	4	2	110	47.6	3	4570	1460	1500	70
30	0	30.14	18.40	22.40	4	3	110	47.6	3	5103	1701	1700	80
30	0	30.14	18.40	22.40	4	4	110	47.6	3	5636	1879	1800	90
30	0	30.14	18.40	22.40	4	5	110	47.6	3	6169	2056	2000	100

 N_c , N_q , N_γ after Meyerhof





APPENDIX E SETTLEMENT ANALYSIS OF EMBANKMENT



APPENDIX C

LABORATORY TEST RESULTS

Summary of Classification Test Results
Grain Size Distribution Curves
Unconfined Compression Curves
Standard Moisture-Density Test Results
CBR Test Results
Summary of Special Laboratory Test Results

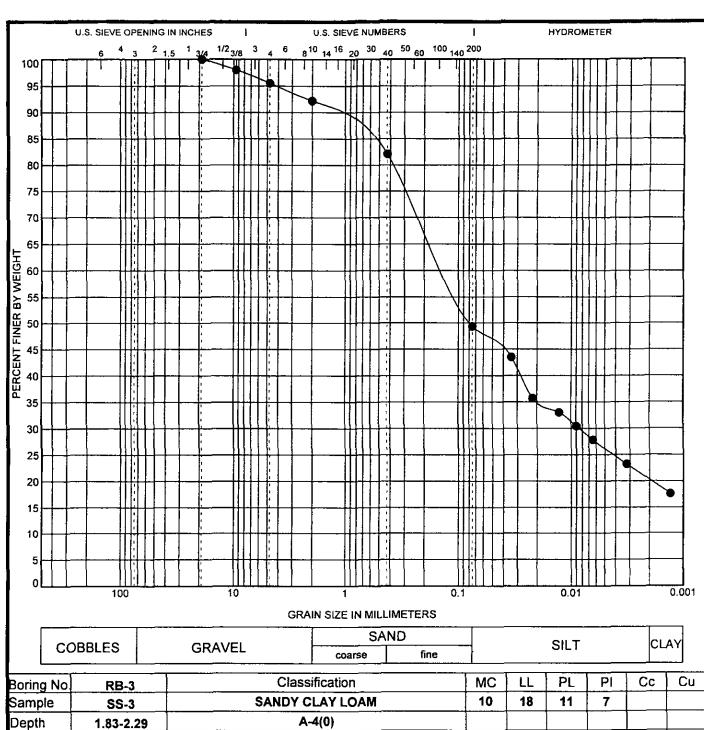


		-	,	_	_	_	,	,
GBR (8)	97%		2.7					
8.8 8.8	93%		2.1					
WC LL PL PI Density Content 93% 97%			13.7					
Max. Dry Density	(Kg/m³)		28.3 32.0 35.1 15 29 14 15 1890.0					
⊡		7	15	1	ΝP	7		
립		=	4	13	5 NP NP NP	13		
1	_	18	8	4	물	23		
 ≪		2	55	4	သ	5		
ution	Silt Clay	20.3	35.1	11.1	19.0	19.4		
strib	Sit	29.	32.(30.6	-	39.7		
Percent Passing Grain Size Distribution (Sieve No.)	40 200 Gravel Sand	42.8	28.3	48.5 30.6 11.1 14 14 13	66.7	3.9 37.5 39.2 19.4 13 20 13		
Grain	Gravel	92.2 82.1 49.4 7.8	4.6	9.8	14.3	3.9		
ssing o.)	200	49.4	95.4 90.2 67.1	41.7	19.0	58.6		
ercent Passi (Sieve No.)		82.1	90.2	81.7	19.4	88.5		
	5	92.2		90.2	85.7	96.1		
AASHTO	d dio	A-4 (0)	A-6 (7)	A-4 (0) 90.2 81.7 41.7 9.8	A-1-b (0) 85.7 19.4 19.0 14.3 66.7	A-4 (1) 96.1 88.5 58.6		i
Soil	Classification	SANDY CLAY LOAM	CLAY	SANDY LOAM	SAND	LOAM (Till)		
Depth		1.83-2.29	0.15-0.91	SS-5 4.11-4.57	8.69-9.14	2.59-3.05		
Sample	2	SS-3	BS-1	SS-5	8-SS	SS-4		
Line		.C.	"C"	c.,	"C"	"C"		
Offset		10 m Rt	5 m Rt	20 m Lt	30 m Rt	C/L		
Station		10+240	10+720	AB 3 RB-10 11+020 20 m Lt	11+080	12+440		
Boring		RB-3	AB 2 RB-7	RB-10	AB 4 RB-12	AB 5 RB-23		
Lab		AB 1	AB 2	AB 3	AB 4	AB 5		

SUMMARY OF CLASSIFICATION TEST RESULTS

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20



}					Caiso	11110						
Boring No.	RB-3			Classificat	ion		MC	LI	_ PL	PI	Co	Cu
Sample	SS-3		SAN	IDY CLAY	LOAM		10	18	3 11	7	<u> </u>	
Depth	1.83-2.29			A-4(0)							<u> </u>	
Station	10+240			LAB 1							<u> </u>	
Offset	10 m Rt										<u> </u>	
Line	"C"							<u>L</u>				
Remarks		D100	D60	D50	D30	D10	%Gra	vel	%Sand	%S	ilt	%Clay
Ì		19	0.132	0.078	0.009		7.8		42.8	29.	1	20.3

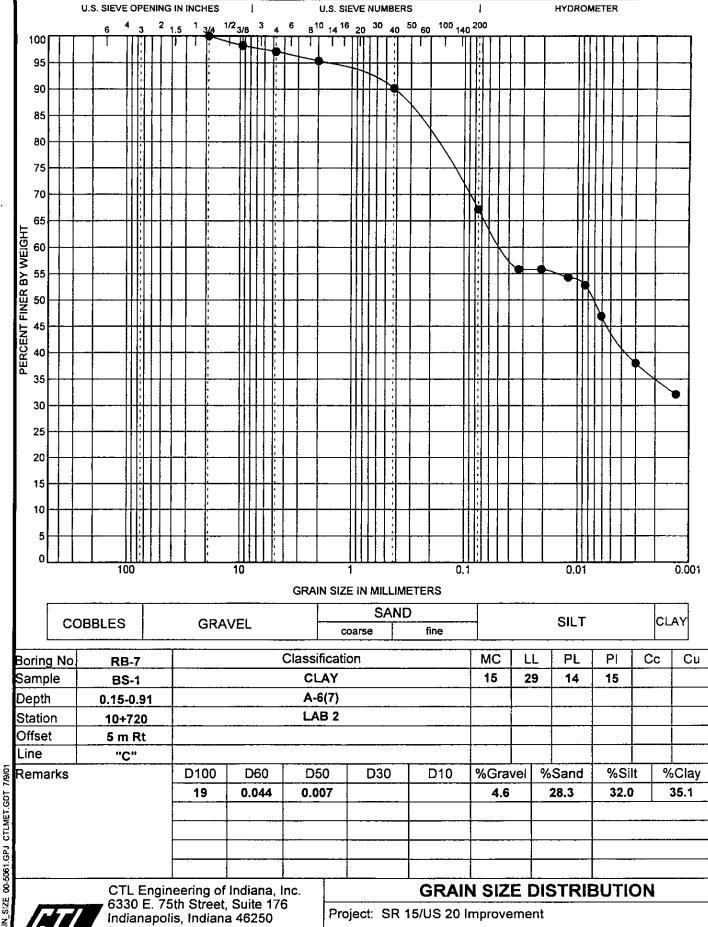


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GRAIN SIZE DISTRIBUTION

Project: SR 15/US 20 Improvement

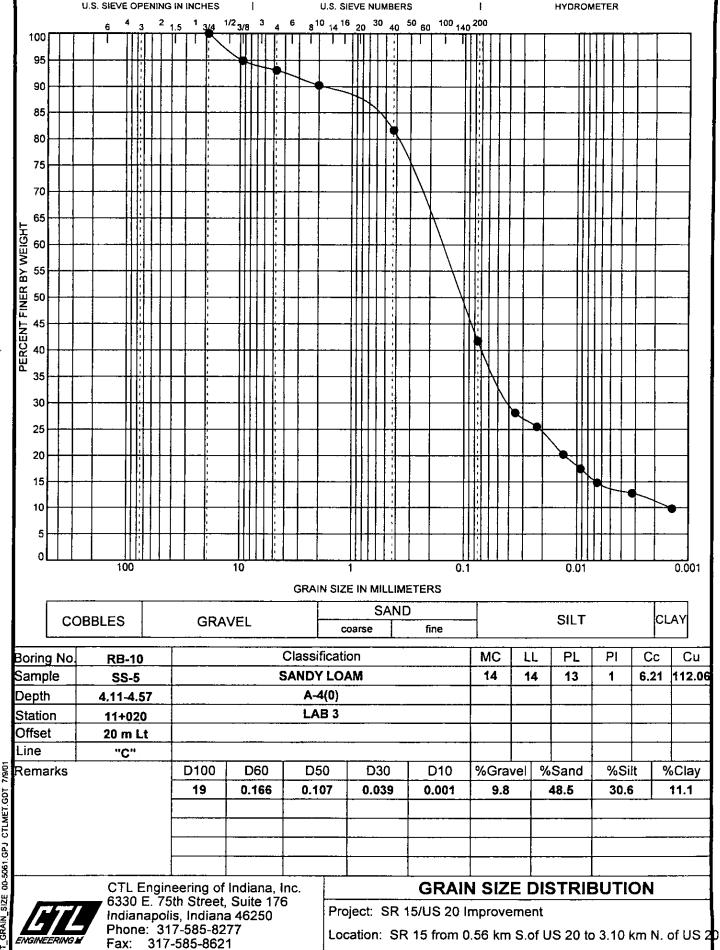
Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20



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e-mail: ctlin@ctleng.com

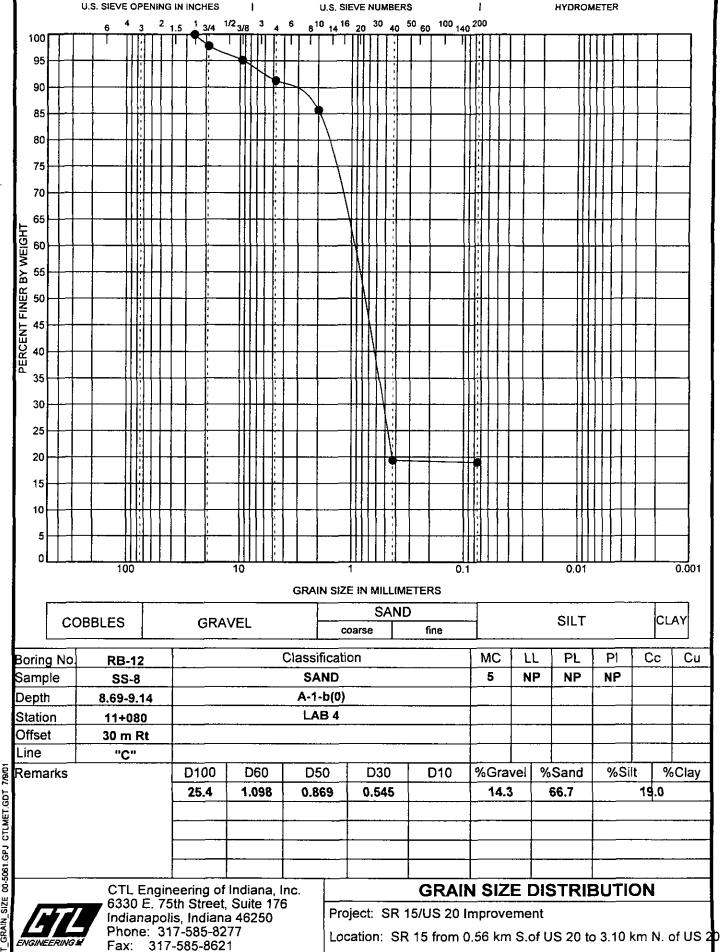
Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20



Project Number: STP-4320 (7), CTL No.: 00-050061

G. 00-5061 GRAIN NDOT

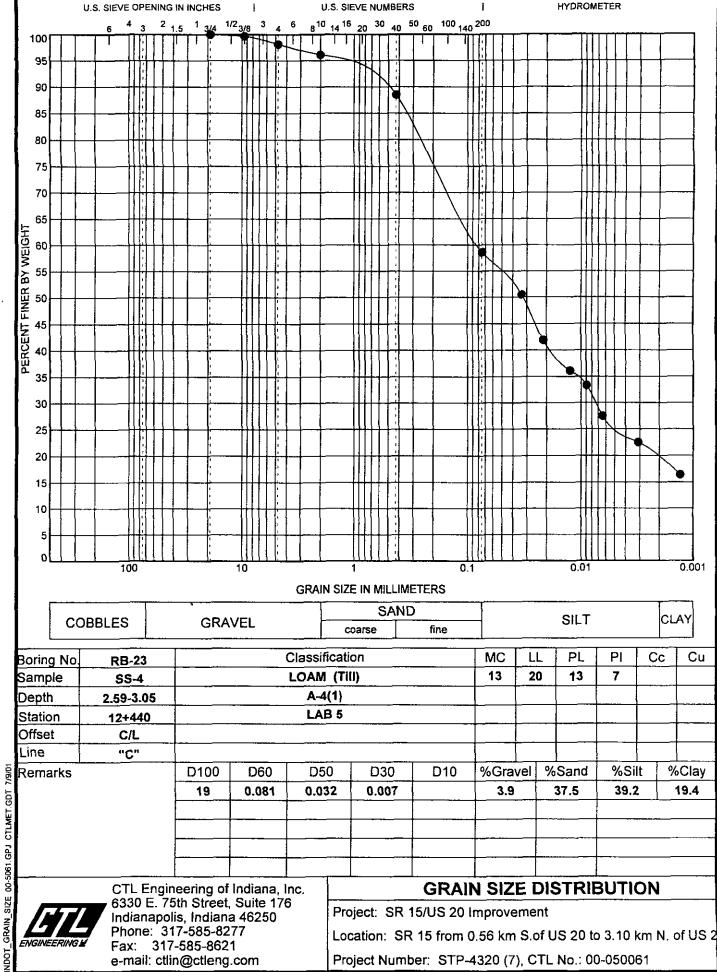
e-mail: ctlin@ctleng.com



Project Number: STP-4320 (7), CTL No.: 00-050061

00-5061.GPJ GRAIN_SIZE

e-mail: ctlin@ctleng.com

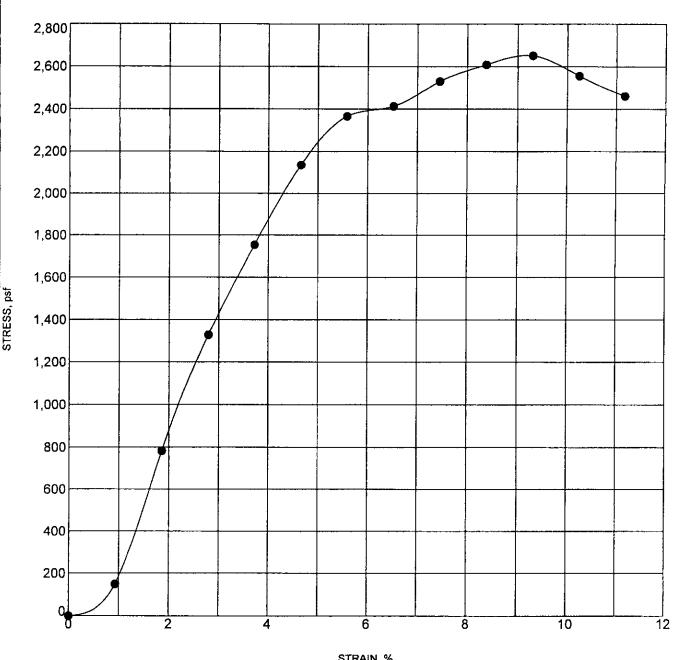




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Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20



STRAIN, 9

Boring In	nformation	Test Results		
Boring No.	RB-11	Natural Moisture Content (%)	17	
Sample	SS-5	Natural Wet Density, pcf (kg/m³)	134.6	(2158)
Depth (m)	4.11 - 4.57	Natural Dry Density, pcf (kg/m³)	115.1	(1844)
Station	11+020	Unconfined Compression Strength, psf (kN/m²)	2651	(127)
Offset	20 m Rt	Failure Strain (%)	9.3	
Line	"C"			

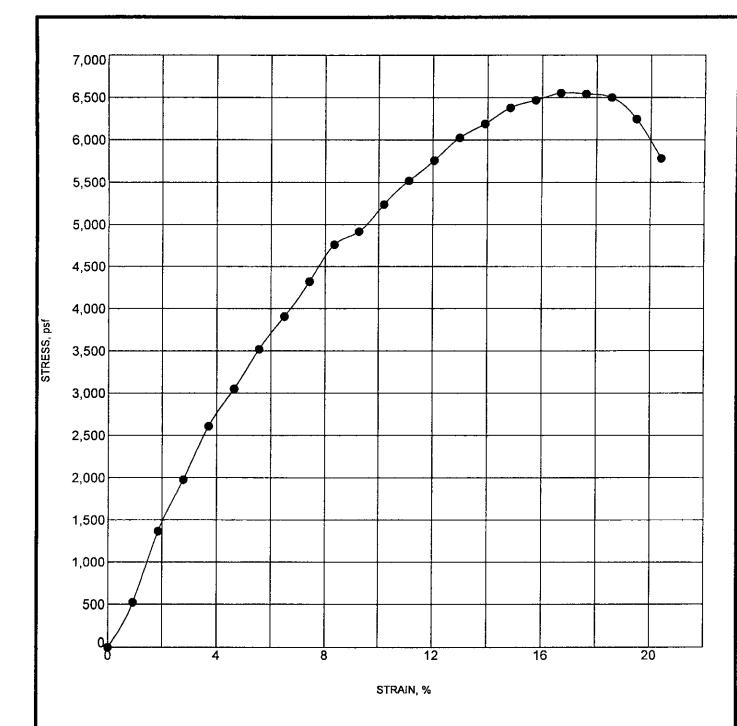


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UNCONFINED COMPRESSION TEST

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20



Boring Ir	formation	Test Results		
Boring No.	RB-12	Natural Moisture Content (%)	11	
Sample	SS-4	Natural Wet Density, pcf (kg/m³)	141.5	(2268)
Depth (m)	2.59 - 3.05	Natural Dry Density, pcf (kg/m³)	127.5	(2043)
Station	11+080	Unconfined Compression Strength, psf (kN/m²)	6552	(314)
Offset	30 m Rt	Failure Strain (%)	16.7	
Line	"C"			

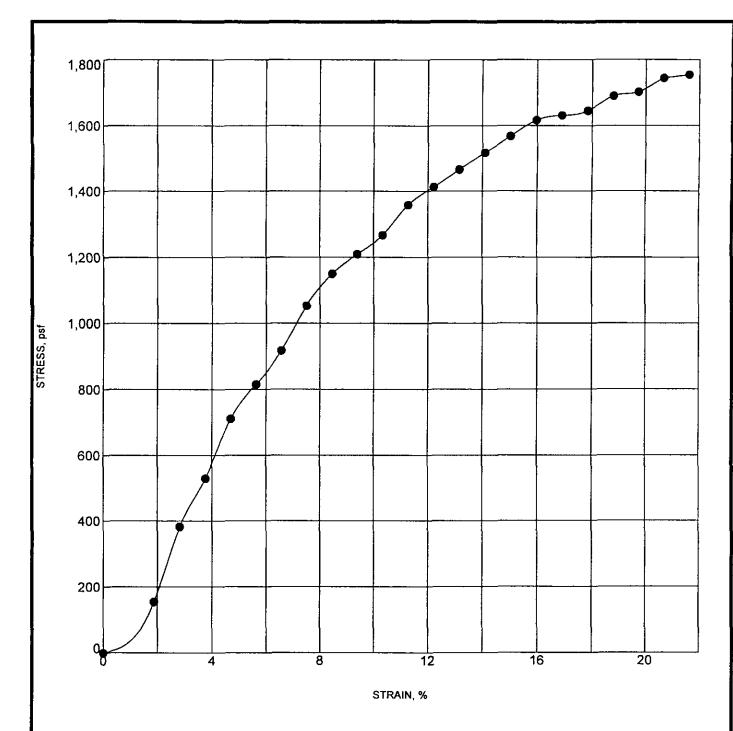


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UNCONFINED COMPRESSION TEST

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20



Boring In	formation	Test Results		
Boring No.	RB-18	Natural Moisture Content (%)	18	
Sample	SS-3	Natural Wet Density, pcf (kg/m³)	141.6	(2269)
Depth (m)	1.83 - 2.29	Natural Dry Density, pcf (kg/m³)	120.0	(1923)
Station	11+800	Unconfined Compression Strength, psf (kN/m²)	1754	(84)
Offset	5 m Lt	Failure Strain (%)	21.6	
Line	"C"			



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UNCONFINED COMPRESSION TEST

Project: SR 15/US 20 Improvement

Location: SR 15 from 0.56 km S.of US 20 to 3.10 km N. of US 20

SUBSURFACE INVESTIGATION ADDENDUM 2

DES. NO.: 8354420
PROJECT NO.: STP-4320(7)
SR 15 FROM 0.34 MI. S. OF US 20 TO 1.92 MI. N. OF US 20
ELKHART COUNTY, INDIANA
CTL PROJECT NO.: 05050045IND

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION MATERIALS AND TESTS DIVISION 120 SOUTH SHORTRIDGE ROAD INDIANAPOLIS, INDIANA 46219

PREPARED BY:

CTL ENGINEERING OF INDIANA, INC. 6848 HILLSDALE COURT INDIANAPOLIS, INDIANA 46250

NOVEMBER 23, 2005



L Engineering of Indiana, Inc.

48 Hillsdale Court, Indianapolis, Indiana 46250 Hone: 317/585-8277 • Fax: 317/585-8621

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Established 1927

November 23, 2005

Indiana Department of Transportation Materials and Tests Division 120 South Shortridge Road Indianapolis, Indiana 46219

Attention:

Mr. Athar Khan, P.E.

Chief Geotechnical Engineer

Reference:

Subsurface Investigation - Addendum 2

Des. No.: 8354420

Project No.: STP-4320(7)

SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20

Elkhart County, Indiana

CTL Project No.: 05050045IND

Dear Mr. Khan:

In accordance with your authorization to proceed, CTL Engineering, Inc. has completed the subsurface investigation on the above referenced site.

The report includes the results of our field and laboratory testing, and our analyses and recommendations for the foundations and earth related phases of the project.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

the Carshi

cc: Mr. Shahid Siddiqui, INDOT - Materials and Tests Division

Offices: Ohio, Indiana, North Carolina, West Virginia

SUMMARY OF SUBSURFACE INVESTIGATION

A subsurface investigation report for the roadway reconstruction on SR 15 and US 20 was prepared and submitted on August 15, 2001. Also, a subsurface investigation — Addendum 1 report was prepared and submitted on March 2, 2004 for the proposed sewer lines. This report is being submitted as an addendum 2. Under this addendum, the project involves the design and construction of one culvert on SR 15 and a culvert extension on US 20 as described below.

Location	Structure	Station	Line	Box Culvert Size	Boring	Flow Lin	e Elevation
Location	No.	Station	Line	Box Curvent Size	No.	Up Stream	Down Stream
SR 15	62	13+885	"B" & "C"	25m of 1194mm x 1804mm Pipe	TB-1 & TB-2	249.00	248.67
US 20	69	5+694	"S-US20-B"	6.0 m of 3910mm x 2235mm Multi Plate Box Culvert (Extension)	TB-3	N/A	N/A

A subsurface investigation for the subject sites has been completed and a summary of our findings and recommendations is reported below. Detailed foundation recommendations and construction considerations are provided in the subsurface investigation report.

FINDINGS

Test borings TB-1 and TB-2, drilled at Structure No. 62, encountered fill material to depths of 3.5 feet (1.07m) and 8.5 feet (2.59m). The fill is described as sand and gravel, sand, sandy loam and/or loam containing varying amounts of roots, organic matter and/or brick fragments. Below the fill, both test borings encountered sand deposits. Boring TB-3, drilled at Structure No. 69, encountered possible fill material over creek sediments to a depth of 8.5 feet (2.59m). Below, layers of clay loam, sand and silt were encountered throughout the drilled depth

Structure No. 62 on SR 15

The borings encountered very loose sand or on very stiff sandy loam fill at the culvert invert elevation. Groundwater is expected during excavation and placement of this culvert. It is recommended that all fill material and very loose sand be removed to a depth of 2 feet (600mm) and replaced with "B" Borrow material or No. 53 aggregate to provide a uniform subgrade below the culvert. A layer of geogrid Type 1 would be needed at the bottom of the excavation. The excavation should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Structure No. 69 on US 20

Very soft creek sediments containing organic matter was encountered at the proposed culvert extension invert elevation. Surface runoff and/or seepage water could be encountered. It is recommended that the soft creek sediments and/or soil containing organic matter be removed and replaced with "B" Borrow material or No. 53 aggregate. It is estimated that the excavation could extend to a depth of 2.5 feet (750mm) below the proposed invert elevation of the culvert. A layer of geogrid Type 1 would be needed at the bottom of the excavation. Removal of the undesirable soil deposits should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Wingwall footings may be designed using the soil parameters provided in the geotechnical report.

This summary is provided for general information only, and it should not be used as the only source for any design, estimating or bidding. Detailed recommendations are provided in the geotechnical report.



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Subsurface Investigation - Addendum 2

Des. No.: 8354420, Project No.: STP-4320 (7)

SR 15 in Eikhart County

CTL Project No.: 05050045IND

November 23, 2005

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I. PROJECT LOCATION AND DESCRIPTION

The project is identified as SR 15 from 0.34 miles south of US 20 to a point 1.92 miles north of US 20 in Elkhart County, Indiana. The project involves the design and construction of two culverts as described in Table 1.

Table 1 - Culverts

	Staniotama				Doring	Flow Li	ne Elevation
Location	Structure No.	Station	Line	Box Culvert Size	Boring No.	Up Stream	Down Stream
SR 15	62	13+885	"B" & "C"	25m of 1194mm x 1804mm Pipe	TB-1 & TB-2	249.00	248.67
US 20	69	5+694	"S-US20-B"	6.0 m of 3910mm x 2235mm Multi Plate Box Culvert (Extension)	TB-3	N/A	N/A

Note that a subsurface investigation report for the roadway reconstruction on SR 15 and US 20 was prepared and submitted on August 15, 2001. Also, a subsurface investigation – Addendum 1 report was prepared and submitted on March 2, 2004 for the proposed sewer lines. This report is being submitted as an addendum 2.

II. SUBSURFACE INVESTIGATION

Three (3) test borings, designated as TB-1, TB-2 and TB-3, were drilled near the proposed culverts to a depth of 20 feet (6.10m) each. TB-1 and TB-2 were drilled for Structure No. 62 and TB-3 was drilled for Structure 69. Locations of the test borings are shown on the Boring Location Plans in Appendix A.

The test borings were advanced with an All-Terrain Vehicle (ATV) drilling rig utilizing hollow stem augers (HSA) on October 25, 2005. Standard Penetration tests were conducted using a 140-pound automatic hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches.

Soil samples obtained from the drilling operation were preserved in glass jars and visually classified in the field and laboratory. Representative soil samples were tested for Natural Moisture Content, pH, Loss on Ignition, Atterberg Limits and Grain Size Distribution.



Subsurface Investigation – Addendum 2 Des. No.: 8354420, Project No.: STP-4320(7)

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Drilling, soil sampling and laboratory testing have been performed following INDOT, AASHTO and current ASTM procedures. Results from field and laboratory tests are shown in Appendix B and Appendix C.

Stations, offsets and surface elevations of the test borings were interpolated from the site plans and cross sections provided to us by INDOT.

III. FINDINGS

A. Soil Profile

Test boringsTB-1 and TB-3 encountered 10 to 12 inches of topsoil at the surface. Boring TB-2 encountered 5 inches of asphalt concrete over 4 inches of cement concrete.

Below the surface cover, TB-1 and TB-2 encountered fill material to depths of 3.5 feet (1.07m) and 8.5 feet (2.59m). The fill is described as sand and gravel, sand, sandy loam and/or loam containing varying amounts of roots, organic matter and/or brick fragments. Below the fill, both test borings encountered sand deposits. A layer of clay loam was encountered in TB-1 at a depth of 19 to 20 feet (5.79m to 6.10 m).

Below the surface cover in test boring TB-3, possible fill material was encountered to a depth of 4 feet (1.22m). Below, silty clay and sandy loam deposits were encountered to a depth of 8.5 feet (2.59m). These deposits are described as creek sediments, which contain traces to little organic matter. Below, layers of clay loam, sand and silt were encountered throughout the drilled depth of 20 feet (6.10m).

Detailed information of soil types, natural moisture content and standard penetration tests are shown on the enclosed test boring records in Appendix B and appended soil profile sheets in Appendix D and E.

B. Groundwater

Groundwater and/or seepage water was encountered in TB-1 and TB-2 at depths of 4.0 feet (1.22m) and 5.6 feet (1.70m), respectively. Groundwater was encountered in TB-3 at a depth of 13 feet (3.96m). Refer to the attached test boring records in Appendix B for detailed groundwater readings.



Subsurface Investigation - Addendum 2

Des. No.: 8354420, Project No.: STP-4320 (7)

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IV. <u>DISCUSSION AND RECOMMENDATIONS</u>

Based upon the soil data obtained from field and laboratory testing, foundation recommendations for each culvert are provided in the following paragraphs.

A. Structure No. 62 on SR 15

The borings encountered very loose sand or on very stiff sandy loam fill at the culvert invert elevation. Groundwater is expected during excavation and placement of this culvert.

Based upon the above findings, it is recommended that all fill material and very loose sand be removed to a depth of 2 feet (600mm) and replaced with "B" Borrow material or No. 53 aggregate to provide a uniform subgrade below the culvert. A layer of geogrid Type 1 would most likely be needed at the bottom of the excavation. The excavation should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

B. Structure No. 69 on US 20

Very soft creek sediments containing organic matter were encountered at the invert elevation of the proposed culvert extension. Surface runoff and/or seepage water could be encountered depending upon the time of construction and amounts of precipitation.

Based upon the above findings, it is recommended that the soft creek sediments and/or soil containing organic matter be removed and replaced with "B" Borrow material or No. 53 aggregate. It is estimated that the excavation could extend to a depth of 2.5 feet (750mm) below the proposed invert elevation of the culvert. A layer of geogrid Type 1 would most likely be needed at the bottom of the excavation. Removal of the undesirable soil deposits should extend for a horizontal distance of 5 feet (1.5m) beyond the limits of the culvert.

Foundation and earthwork recommendations for both culverts are provided in the following paragraphs.



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SR 15 in Elkhart County

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- 1. The recommended allowable soil bearing pressures and the soil parameters required for the design of footings and wingwalls are provided in Table 2. These values apply to all design loads. Additional soil information may be found in the enclosed Test Boring Records in Appendix B and the soil profiles in Appendix D and E. Note that the allowable soil bearing pressures provided in Table 2 are based on the assumption that the wingwall footings will be placed at 4 feet (1.3m) below the proposed flowline.
- 2. Settlements of footings may vary at the culvert location due to variations in soil composition, void ratio and loading. It is estimated that total and differential settlements would be within tolerable limits.
- 3. The pH values obtained from the laboratory testing ranged from 8.4 to 8.7.
- 4. Temporary excavations in excess of 5.0 feet in depth should be sloped, braced and/or shored according to OSHA requirements. Excavation to bottom of the recommended footing depth and in fill areas may be accomplished using standard excavation equipment.
- 5. Prior to placement of footings, the recommended soil bearing pressure should be verified and approved by a qualified Engineering Technician under the supervision of a Geotechnical Engineer. Soft and/or loose soils not meeting the recommended soil pressure, should be removed, dried and recompacted or undercut and replaced with lean concrete, No. 53 aggregate, or as otherwise directed by the Engineer.
- 6. Groundwater and/or surface runoff is expected during construction at Structure 62. At this Structure, the sand deposits containing groundwater extend to Elevation 244.2±. Surface runoff and/or seepage water could be encountered at Structure 69 depending upon the time of construction and amounts of precipitation. Dewatering, if needed, may be accomplished using construction sump pump(s), or any dewatering system approved by the engineer.
- 7. Borrow type and placement, and drainage structure installations including footings should be in accordance with INDOT Standard Specifications and the culvert manufacturer recommendations.



Subsurface Investigation – Addendum 2 Des. No.: 8354420, Project No.: STP-4320(7)

SR 15 in Elkhart County

CTL Project No.: 05050045IND

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Table 2 - Soil Parameters for Wingwall Design

Soil Parameters	Estimate	d Values
Son i diameters	Structure 62	Structure 69
Allowable Soil Bearing Pressure, psf *	**	1000 ***
Angle of Internal Friction of Foundation Soil (φ), degrees	30	0
Friction Angle between Foundation Soil and Concrete (δ), degrees	20	0
Ultimate Cohesion of Foundation Soil (C), psf	0	600
Ultimate Adhesion between Footings and Foundation Soil (Ca), psf	0	400
Friction Angle of Backfill Material, degrees	30	30
Friction Angle between Wall and Backfill (δ _f), degrees	20	20
Unit Weight of Foundation Soil, pcf	115	110

^{*} Allowable soil bearing pressures are provided at a depth of 4 feet below the culvert invert elevations.

**	Width of Footings (feet)	Allowable Soil Bearing pressure (psf)
	2	700
	3	800
	4	900
	5	1000
	6	1100

*** Undrained shear method used. Recommended soil bearing pressure is estimated for the clay loam encountered between a depth of 2.69 m and 3.96m.

V. CONCLUDING REMARKS

A. Changed Conditions

Should plans for the proposed culverts be changed from those used in preparing this report, CTL Engineering of Indiana, Inc. (CTL) should be notified to make the necessary modifications to our recommendations to account for the changed conditions.



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SR 15 in Elkhart County

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В. **Testing and Observation**

Experience shows that the subsurface soil conditions in an area sometimes vary from the ones indicated in the test borings at their specific locations. It is therefore recommended that an Engineering Technician, under the supervision of a qualified Professional Engineer be retained on the site to monitor the construction of spread footings and earthwork operations.

C. Closure

CTL has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analyses, conclusions, recommendations and other work product of CTL are instruments of service for this project only.

CTL assignment does not include, nor does this geotechnical report address the environmental aspects of this site.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

Indiana Reg. No. 60900551

L' Karshi

Paul L. Douglass, P.E.

Principal Engineer

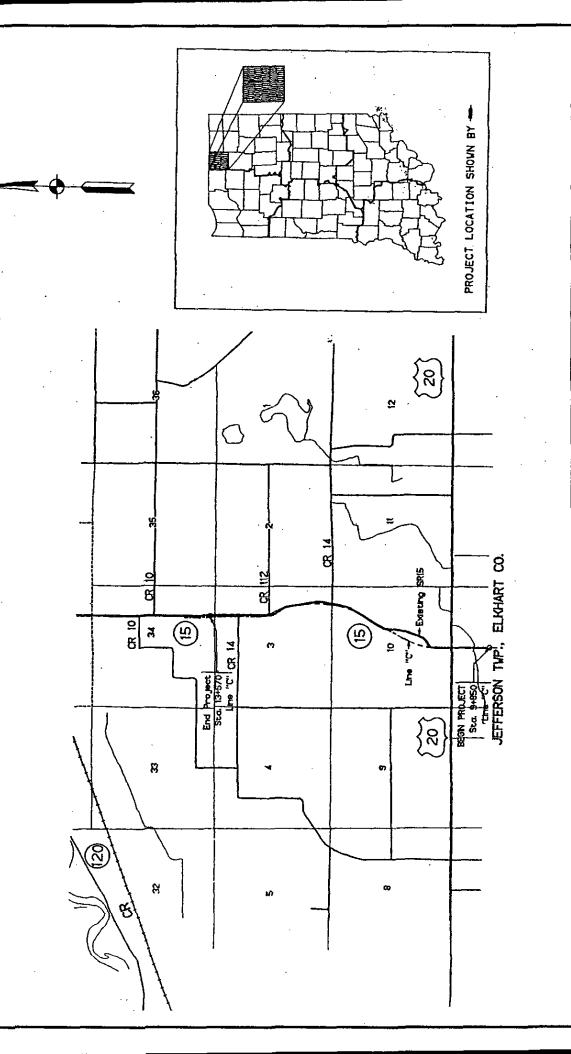
Indiana Reg. No. 60012388



900551

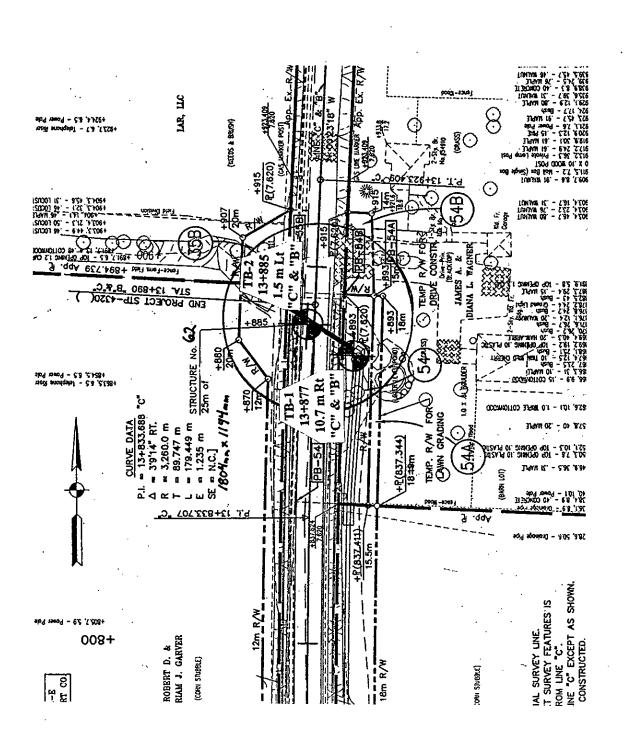
APPENDIX A

GENERAL SITE PLAN BORING LOCATION PLANS



GENERAL SITE PLAN

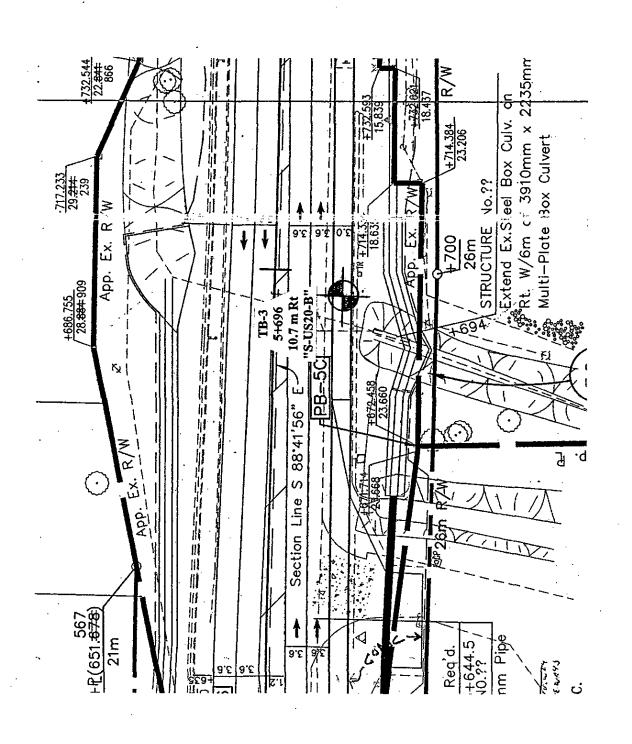
SR 15/ US 20 Improvement
SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20
Des. No.: 8354420, Project No.:: STP-4320(7)
Elkhart County, Indiana



BORING LOCATION PLAN

SR 15/ US 20 Improvement SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20 Des. No.: 8354420, Project No.:: STP-4320(7)

Elkhart County, Indiana



BORING LOCATION PLAN

SR 15/ US 20 Improvement SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20 Des. No.: 8354420, Project No.:: STP-4320(7)

Elkhart County, Indiana

APPENDIX B
TEST BORING RECORDS

TEST BORING RECORD CLIENT : Indiana Department of Transportation BORING NO.: **TB-1 PROJECT** : SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20 SHEET OF LOCATION : Elkhart County, Indiana DATE STARTED : 10-25-05 DES NO. 8354420; Project No.: STP-4320; CTL No.: 05050045IND DATE COMPLETED: 10-25-05 BORING ELEVATION: 250.00 m (USC&GS) BORING METHOD: HSA **HAMMER** : Automatic **STATION** 13+877 **RIG TYPE** : CME-550 ATV DRILLER : ED **OFFSET** 10.7m Rt CASING DIA. : 83 mm I.D. TEMPERATURE: 50° F LINE "C" & "B" **DEPTH** CORE SIZE 6.10 m WEATHER : Cloudy ▼ At Completion 1.22 m GROUNDWATER: Encountered at 1,22 m 學 Caved in at <u>1.37 m</u> Unconfined Compression (kN/m²) Moisture Content (%) £ SPT / 15cm Atterberg Total Unit Weight (kg/m²) Stratum Elevation Recovery (%) Limits SPT/30 SOIL/MATERIAL DESCRIPTION Sample Depth Stratum Depth Sample Number PL ΡI TOPSOIL (305mm) (Visual) 249.70 0.30 2 2 **SS-1** 5 Brownish Black, Moist, Soft, LOAM with 89 23 Traces of Roots and Organic Matter (FILL) 3 248.93 2 2 SS-2 4 89 2 3 **SS-3** 10 100 4 6 6 **SS-4** 7 14 89 3.0 7 Brown, Wet, Very Loose to Medium Dense, SAND with Traces of Gravel Visual) **SS-5** 5 100 12 4.5 244.21 5.79 11 Gray, Moist, Very Stiff, CLAY LOAM (TILL) SS-6 13 30 100 15 6.0 243.90 A-4 As Lab 2 6.10 17 Bottom of Boring at 6.10 meters Boring performed for Structure No. 62. Boring backfilled with soil cuttings. **ABBREVIATIONS BORING METHOD SAMPLING METHOD** - Hand Penetrometer HSA - Hollow Stem Auger - Split Spoon Sample SS - Liquid Limit SFA - Solid Flight Auger ST - Shelby Tube Sample LL RC - Rock Coring CR - Rock Core Sample PL **Plastic Limit** ы MD - Mud Drilling BS - Bag Sample Plasticity Index CTL Engineering of Indiana, Inc. - Standard WD - Wash Drilling AC SPT Auger Cuttings Phone: 317-585-8277 - Hand Auger Penetration Test HA

TEST BORING RECORD CLIENT : Indiana Department of Transportation BORING NO.: **PROJECT** : SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20 SHEET OF LOCATION : Elkhart County, Indiana DATE STARTED : 10-25-05 DES NO. 8354420; Project No.: STP-4320; CTL No.: 05050045IND DATE COMPLETED: 10-25-05 BORING ELEVATION: 250.70 m (USC&GS) BORING METHOD: HSA **HAMMER** : Automatic **STATION** 13+885 RIG TYPE CME-550 ATV DRILLER : ED **OFFSET** 1.5m Lt TEMPERATURE: 50° F CASING DIA. 83 mm I.D. LINE "C" & "B' **DEPTH** 6.10 m CORE SIZE WEATHER : Sunny **GROUNDWATER:** Encountered at 2.74 m At Completion 1.70 m E Caved in at 2.44 m Unconfined Compression (kN/m²) Moisture Content (%) Atterberg SPT/ 30 cm SPT / 15cm Total Unit Weight (kg/m²) Stratum Elevation Recovery (%) Limits Sample Depth SOIL/MATERIAL DESCRIPTION Sample Number Stratum Depth PL Ы LL ASPHALT CONCRETE (127mm) (Visual) 250.57 0.13 CEMENT CONCRETE (102mm) (Visual) 250.47 -0.23 \mathcal{O} 8 Ò, Brown, Slightly Moist, Medium Dense, SAND & **SS-1** 9 78 19 b.0 **GRAVEL (FILL)** 10 (Visual) 0 249.63 1.07 8 **SS-2** Brownish Gray, Moist, Medium Dense, SAND 8 14 89 with Traces of Brick Fragments (FILL) 6 (Visual) 248.87 1.83 11 Brown, Moist, Very Stiff, SANDY LOAM with SS-3 14 30 33 14 Traces of Brick Fragments (FILL) 16 A-4 As Lab 1 2.59 248.11 8 **SS-4** 10 22 100 12 6 Brown, Moist to Wet, Medium Dense, SAND **SS-5** 17 100 8 4.5 (Visual) SS-6 5 100 11 6.0 244.60 6.10 6 Bottom of Boring at 6.10 meters Boring performed for Structure No. 62. Two attempts made on SS-3 due to low soil recovery. Boring backfilled with soil cuttings, and pavement restored with concrete patch. **ABBREVIATIONS BORING METHOD** SAMPLING METHOD - Hand Penetrometer HSA - Hollow Stem Auger SS - Split Spoon Sample - Liquid Limit SFA - Solid Flight Auger ST - Shelby Tube Sample LL - Plastic Limit RC - Rock Coring CR - Rock Core Sample MD - Mud Drilling - Bag Sample - Plasticity Index CTL Engineering of Indiana, Inc. SPT - Standard WD - Wash Drilling AC - Auger Cuttings Phone: 317-585-8277 **Penetration Test** HA - Hand Auger

TEST BORING RECORD CLIENT : Indiana Department of Transportation BORING NO.: TB-3 **PROJECT** : SR 15 from 0.34 mi, S. of US 20 to 1.92 mi, N. of US 20 OF 1 SHEET LOCATION : Elkhart County, Indiana : 10-25-05 DATE STARTED DES NO. : 8354420; Project No.: STP-4320; CTL No.: 05050045IND DATE COMPLETED: 10-25-05 BORING ELEVATION: 261.15 m (USC&GS) **BORING METHOD: HSA** HAMMER : Automatic **STATION** : 5+696 **RIG TYPE** : CME-550 ATV DRILLER : ED **OFFSET** 10.7m Rt CASING DIA. TEMPERATURE: 50° F : 83 mm I.D. LINE "S-US20-B" **DEPTH** 6.10 m **CORE SIZE** WEATHER : Cloudy Encountered at 3.96 m At Completion 5.49 m GROUNDWATER: E Caved in at 5.56 m Unconfined Compression (kN/m²) Moisture Content (%) SPT / 15cm Ê Atterberg Stratum Elevation Total Unit Weight (kg/m³) Recovery (%) Limits Sample Number **SOIL/MATERIAL DESCRIPTION** Stratum Depth SPT/30 Sample Depth Ê ΡŁ ΡI LL TOPSOIL (254mm) (Visual) 260.90 0.25 2 SS-1 2 78 4 Brown, Moist, Very Loose, SAND with Traces 2 of Roots (Possible Fill) (Visual) SS-2T 2 3 89 259.93 1.22 Dark Brownish Black, Moist, Very Soft, SILTY 1 SS-2B 47 1.5 **CLAY** with Little Organic Matter (Creek 2 Sediments) (Visual) Organic Matter = 10.8% 259.32 1.83 2 Brown with Gray Streaks, Very Moist, Soft, **SS-3** NP NΡ SANDY LOAM with Traces of Roots (Creek 2 4 78 12 NP Sediments) 2 A-4 (0) Lab 1 258.56 2.59 2 SS-4 10 2 5 78 14 22 12 3.0 3 Gray, Moist, Soft, CLAY LOAM (TILL) A-4 (3) Lab 2 257.19▼ **SS-5** 5 100 11 4.5 Gray, Wet, Medium Dense, SAND 6 (Visual) 255.97 5.18 +++ Gray, Moist, Medium Dense, SILT +++ (Visual) +++ SS-6 6 14 100 18 6.0 +++ 255.05 6.10 Bottom of Boring at 6.10 meters Boring performed for Structure No. 69. Boring backfilled with soil cuttings. **ABBREVIATIONS BORING METHOD SAMPLING METHOD** - Split Spoon Sample HSA - Hollow Stem Auger SS - Hand Penetrometer SFA - Solid Flight Auger ST - Shelby Tube Sample - Liquid Limit RC - Rock Coring CR - Rock Core Sample PL - Plastic Limit ы MD - Mud Drilling BS - Bag Sample - Plasticity Index CTL Engineering of Indiana, Inc. WD - Wash Drilling SPT - Standard AC - Auger Cuttings Phone: 317-585-8277 **Penetration Test** HA - Hand Auger

APPENDIX C

LABORATORY TEST RESULTS

Summary of Classification Test Results Grain Size Distribution Curves Summary of Special Laboratory Test Results

Boring Lab	g S	Station	Station Offset	Line	Sample	Depth	Soil	AASHTO (Sieve No.)	Perce (Si	eve No	sing (.	Grain (Percent Passing Grain Size Distribution (Sieve No.) (%)	stribut	<u>5</u>	Š	<u>_</u>		Max. Dr. Density	Optimum Moisture	ion Max. Dry Optimum Resilient WC LL Pt Pi Density Moisture Modulus
	<u>.</u>				2	•	Classincation	dnois	5	6	200	ravel	10 40 200 Gravel Sand Silt Clay	Silt	jā	_	<u> </u>		(bc)	Content (%)	(isd)
TB-3	Lab 1	969+9	10.7m Rt	"S-US20-B"	· SS-3	1.83-2.29	TB-3 Lab 1 5+696 10.7m Rt "S-US20-B" SS-3 1.83-2.29 Sandy Loam A-4 (0) 88.3 77.3 40.6 11.7 47.7 29.2 11.4 12 NP NP NP	A-4 (0)	88.3	77.3	60.6	11.7	47.7	29.2	4.	<u>Z</u>	ᆸ	₽ 2		,	
TB-3	Lab 2	5+696	10.7m Rt	TB-3 Lab 2 5+696 10.7m Rt "S-US20-B" SS-4 2.59-3.05 Clay I	SS-4	2.59-3.05	Clay Loam	A-4 (3) 97.5 90.6 63.4 2.5 34.0 40.4 23.1 14 22 12 10	97.5	9.06	53.4	2.5	8.0	40.4	3.1	4 2	12	2			
										1		1		1	1		-				



SUMMARY OF CLASSIFICATION TEST RESULTS

Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

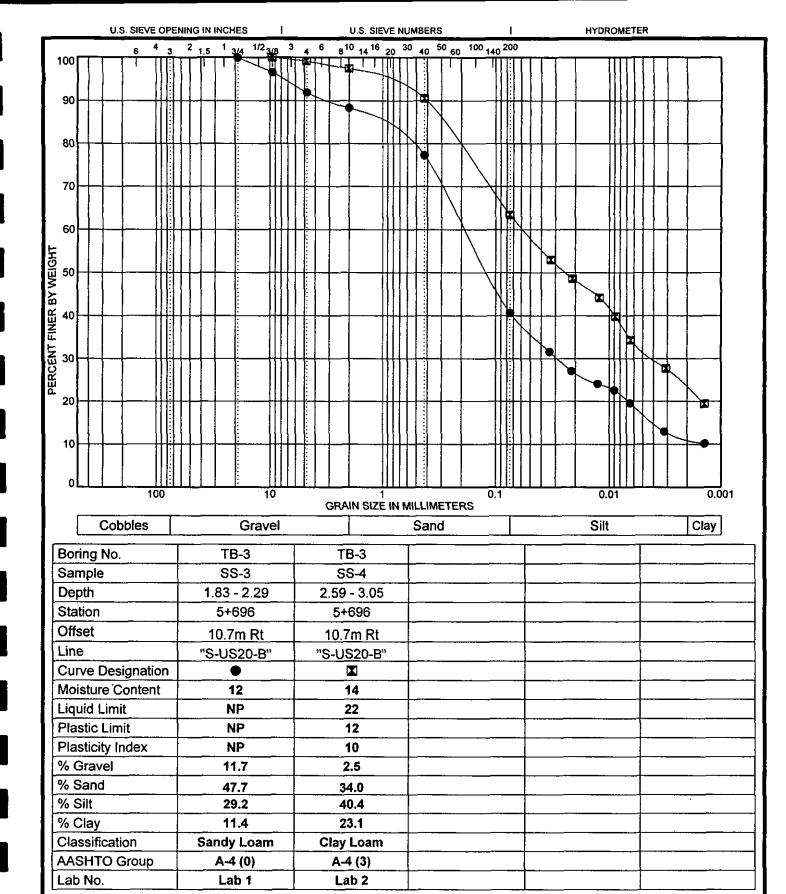
Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

CTL Engineering of Indiana, Inc.

Des. No.: 83

Not. Cassification_Metric 05050045_SR20&SR15.GPJ CTL.GDT 112306





CTL Engineering of Indiana, Inc.

Phone: 317-585-8277

GRAIN SIZE DISTRIBUTION

Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

Sheet 1 of 1

Boring No.	Station	Offset	Line	Sample No.	Depth (m)	Moisture Content (%)	Loss on Ignition (%)	рН
TB-1	13+877	10.7m Rt	"C" & "B"	SS-1	0.30-0.76	23		
TB-1	13+877	10.7m Rt	"C" & "B"	SS-6	5.64-6.10	15		
TB-2	13+885	1.5m Lt	"C" & "B"	SS-3	1.83-2.29	14		
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-2B	1.22-1.52	47	10.8	
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-3	1.83-2.29	12		8.4
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-4	2.59-3.05	14		8.7
TB-3	5+696	10.7m Rt	"S-US20-B"	SS-6	5.64-6.10	18		

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

ENGINEERING # CTL Engineering of Indiana, Inc. Phone: (317) 585-8277

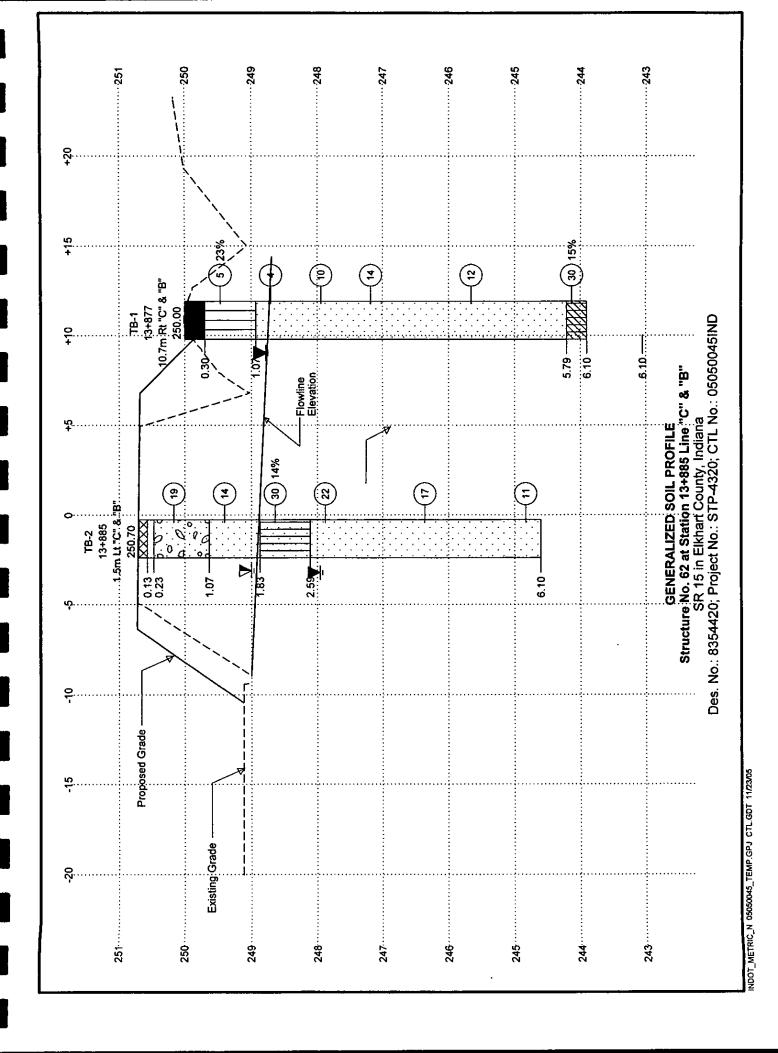
Project: SR 15 from 0.34 mi. S. of US 20 to 1.92 mi. N. of US 20

Location: Elkhart County, Indiana

Des. No.: 8354420; Project No.: STP-4320; CTL No.: 05050045IND

APPENDIX D

Structure No. 62
Generalized Soil Profile
Soil Bearing Capacity Analysis



BEARING CAPACITY ANALYSES

Culvert.:

Box Culvert

Location:

SR 15 in Elkhart County

Structure No.: 62, 25m of 1194mm x 1804m Pipe (Boring No. TB-1 and TB-2)

Des. No.:

8354420

CTL No.:

05050045IND

SOIL BEARING CAPACITY

1. Very loose sand or very stiff sandy loam in-place fill exist below the proposed culvert. It is recommended that the in-place fill be removed and replaced with "B" Borrow to maintain uniform base for the culvert. Note that the 30 bpf encountered in the sandy loam fill may be due to striking on brick fragments. This value may not be represent the consistency of the entire in-place fill.

Footings for wingwalls would be founded on loose to medium dense sand with:

N = 4 to 22 bpf

Estimated Phi = 29 deg., C = 0, G = 115 pcf & $G_{sub} = 115 - 62 = 53$ pcf

2. Water expected above footings (longterm)

3. Assume depth of footings,

D_f = At 4' below flow line, and

B = 2'

B = 3

B = 4

B = 5

B = 6

Ultimate Bearing Capacity,

qult = c Nc + (Gsub Df Nq) + (0.5 Gsub B NGamma)

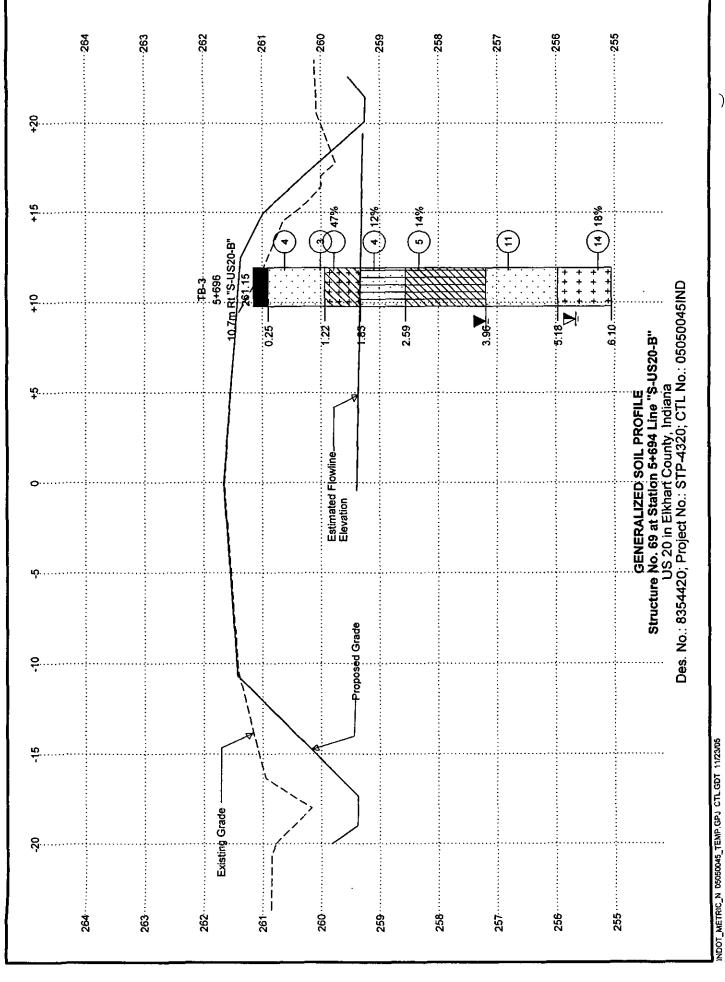
Allowable Bearing Capacity, qall = (qult - Gsub Df) / FS

Phi (degrees)	c (psf)	N _c	N _q	N _{Gamma}	D _f (feet)	В	G (pcf)	G _{sub} (pcf)	FS	Q _{ult} (psf)	Q _{alf} (psf)	USE Qall (psf)
29	0	27.86	16.44	19.34	4	2	115	53	3	4510	1433	1400
29	0	27.86	16.44	19.34	4	3	115	53	3	5023	1604	1600
29	0	27.86	16.44	19.34	4	4	115	53	3	5535	1845	1800
29	0	27.86	16.44	19.34	4	5	115	53	3	6048	2016	2000
29	0	27.86	16.44	19.34	4	6	115	53	3	6560	2187	2100

 N_c , N_q , N_{Gamma} after Meyerhof

APPENDIX E

Structure No. 69
Generalized Soil Profile
Soil Bearing Capacity Analysis



BEARING CAPACITY ANALYSES

Culvert .:

Box Culvert

Location:

US 20 in Elkhart County

Structure No.: 69, 6.0m of 3910mm x 2235mm Multi Plate Box Culvert (Boring No.: TB-3)

Des. No.:

8354420

CTL No.:

05050045IND

DATA

1. Box Culvert extending 6.0 meters to the right of Line "S-US20-B"

2. Invert Elevation = 260.3 (assumed). It is recommended that all creek sediment and/or soils with organic matter be removed to Elevation 258.5. The excavation should be backfilled with compacted No. 53 aggregate. A layer of geogrid Type 1 would be needed at the bottom of the excavation.

3. Groundwater is not expected. However, runoff and/or seepage water could be present.

SOIL BEARING CAPACITY

The soil bearing capacity provided below could be used for wingwall footings. It is assumed that footings will be constructed onto the clay loam soils.

Qu = 1200 psf (Estimated based on blowcounts). Cu = 1200 / 2 = 600 psf

For Phi = 0, Nc = 5.14 (Meyerhof)

Ultimate Bearing Capacity,

 $quit = c Nc = 600 \times 5.14 = 3084 psf$

Allowable Bearing Capacity, qall = qult / FS = 3084 / 3.0 = 1028 psf

USE gall ≈ 1000 psf



The Indiana Department of Transportation

Office of Geotechnical Engineering

120 South Shortridge Road P.O. Box 19389 Indianapolis, Indiana 46219-0389

Phone: (317) 610-7251 Fax: (317) 356-9351

Driving Indiana's Economic Growth

January 25, 2006

CTL Engineering, Inc. 6848 Hillsdale Court Indianapolis, Indiana 46250

Attn: M

Mr. Ali Karaki

Subject:

Des No:

8354420

Project No:

STP - 4320(7)

SR 15 from 0.34 Mi, S of US 20 to 1.92 N. of US 20

County:

Elkhart

District:

Fort Wayne

Gentlemen:

In accordance with the agreement dated January 16, 2004, the Final Quantities and Costs for the Geotechnical Investigation on the subject project have been calculated. Transmitted herewith is one copy of the following:

- 1. Itemization of Pay Quantities for Geotechnical Borings, and Tests.
- 2. Report of Final Costs for the Geotechnical Investigation.
- 3. Performance Evaluation of Consultant's Highway Development Services.

The total cost for the Geotechnical Work performed on the subject project is \$5,442.45 Therefore, in order to finalize the payment, please submit an invoice voucher for \$5,442.45 to:

Mr. Athar Khan, P.E. Chief Geotechnical Engineer INDOT Division of Materials and Tests 120 South Shortridge Road P.O. Box 19389 Indianapolis, IN 46219-0389

If you have any questions concerning this matter, please call us.

Very truly yours,

Athar Khan

Chief Geotechnical Engineer

S.S. Hramay Somanath Hiremath

Geotechnical Engineering Group Leader

SSH/SS

cc:

Mr. R. Asadi

File (Attachments)

			<u>Un</u>	<u>it</u>	Unit Price	<u>Total</u>
			Subtotal (Ged	otechnica	l Engineering)	\$2,000.00
	CONST	RUCTION INSPECTION A	ND MONITOR	<u>ING</u>		
63.	Field inspector		0	hr	\$53.00	
64.	Monitoring geotechnical instrumentation		0	hr	\$53.00	
65.	Integrity testing	cost plus 10%	0	1.1	\$0.00	\$0.00
66.	Dynamic pile analysis		0	ea	\$850.00	
6 7.	Static load test		0	ea	\$850.00	
68.	Dynamic pile load test	cost plus 10%	0	1.1	\$0.00	\$0.00
69.	CAPWAP-C analysis		0	ea	\$400.00	
70.	Final construction inspection report		0	ea	\$80.00	
		Subtotal (Con	struction Ins	ection a	nd Monitoring)	\$0.00
	FOUNDATION	EVALUATION BY NON-D	ESTRUCTIVE	METHOD	<u>s</u>	
71.	a. Surface test/Pier or foundation	cost plus 10%	0	1.1	\$0.00	\$0.00
	b. Borehole test/Pier or foundation	cost plus 10%	0	1.1	\$0.00	\$0.00
	PAVEMENT INVESTIGATION					
1,	Mobilization of coring equipment		0	LS	\$90.00	
2.	Mobilization mileage for coring equipmen	t	0	mi	\$1.40	
3.	Pavement core (partial depth)		0	ea	\$106.00	
4.	Pavement core (full depth)		0	ea	\$150.00	
5.	Sub-base sample		0	ea	\$49.00	
6.	Cement concrete pavement core density	determination	0	ea	\$26.25	
7.	Cement concrete core compressive stren	gth test	0	ea	\$28.50	
8.	Bituminous extraction test		0	ea	\$67.00	
9.	Sieve analysis of extracted aggregate tes	t	0	ea	\$47.00	
10.	Recovery of asphalt from solution by Abs	on method	0	ea	\$360.00	
11.	Theoretical maximum specific gravity tes	t	0	ea	\$65.00	
12.	Bulk specific gravity test		0	ea	\$27.00	
13.	Air voids calculation		0	ea	\$23.00	
14.	Core report for partial depth core		0	ea	\$27.00	
15.	Core report for full depth core		0	ea	\$36.75	
16.	Pavement analysis and report		0	ea	\$630.00	
			Subtotal (I	Pavemen	t Investigation)	\$0.00
	Final Cost of Geotechnical Field		\$3,14	9.60		
	Final Cost of Geotechnical Laboratory	1	\$292	2.85		
	Final Cost of Geotechnical Engineerin	g	\$2,00	00.00		
	Final Cost of Construction Inspection	and Monitoring	\$0.	00		
	Final Cost of Pavement Investigation		\$0.	00		
	Final Cost of Geotechnical and Pavem	ent Investigation	\$5,44	2.45		

PREPARED BY: Alebachew Tilahun CHECKED BY: Shahid Siddiqui

DATED: 1/24/2006

		Unit		Unit Price	<u>Total</u>
	First mile	0	LS	\$290.00	
	Each additional mile	0	mi	\$180.00	
55.	Geotechnical report				
	a. Without soil subgrade investigation				
	First mile	1	LS	\$1,200.00	\$1,200.00
	Each additional mile	0	mi	\$525.00	
	b. With soil subgrade investigation				
	First mile	0	LS	\$1,500.00	
	Each additional mile	0	mi	\$630.00	
	c. Soil subgrade investigation (only)				
	First mile	0	LS	\$500.00	
	Each additional mile	0	mi	\$300.00	
56.	Settlement analysis and recommendations for embankment				
	a. Proposed embankment	0	ea	\$400.00	
	b. Proposed and existing embankment	0	ea	\$450.00	
57	Ground modification design	0	ea	\$1,155.00	
58.	Sliding block slope stability analysis				
	a. C, Ø or C & Ø analysis	0	ea	\$520.00	
	b. Corrective measures	0	ea	\$650.00	
	c. Stage construction corrective method	0	ea	\$1,155.00	
59.	Bridge foundation analysis and recommendations				
	a. Shallow foundation	2	ea	\$400.00	\$800.00
	b. Deep Foundation	0	ea	\$690.00	
	c. Settlement analysis for bridge pier foundation				
	i. Bridge pier	0	ea	\$300.00	
	ii. Embankment plus pier	0	ea	\$350.00	
	iii. Embankment plus pier plus all other loads	0	ea	\$400.00	
	d. Foundation on bedrock	0	ea	\$230.00	
60.	Retaining structure analysis recommendations				
	 Conventional retaining structures and other types such as MSE Walls and Bin walls 				
	i. Shallow foundation	0	ea	\$685.00	
	ii. Deep foundation	0	ea	\$865.00	
	iii. Settlement analysis for retaining wall foundation	0	ea	\$300.00	
	b. Pile retaining structure analysis and recommendations				
	i. Free standing structure	0	ea	\$690.00	
	ii. Retaining structure with tie-back system	0	ea	\$1,155.00	
	c. Drilled-in-pier retaining structure analysis				
	i. Free standing structure	0	ea	\$800.00	
	ii. Retaining structure with tie-back system	0	ea	\$1,185.00	
	d. Soil nailing wall analysis	0	ea	\$800.00	
61.	Seepage analysis	0	ea	\$1,090.00	
62.	Deep dynamic compaction analysis	0	ea	\$1,040.00	

			<u>Un</u>	<u>it</u>	Unit Price	Total
36.	Traffic control					
	a. Flag crew		1	day	\$450.00	\$450.00
	b. Equipment Rental	cost plus 10%	0	1.1	\$0.00	\$0.00
37.	Centerline surveying	cost plus 10%	0	1.1	\$0.00	\$0.00
		GEOTECHNICAL LABORA		tal (Geot	echnicał Field)	\$3,149.60
38.	Sieve analysis		2	ea	\$37.00	\$74.00
39.	Hydrometer analysis		2	ea	\$40.50	\$81.00
40.	Moisture content test		7	ea	\$5.00	\$35.00
41.	Liquid limit		1	ea	\$25.50	\$25.50
42.	Plastic limit & plasticity index		2	ea	\$18.50	\$37.00
43.	a. Unconfined compression test		0	ea	\$32.50	
	 b. Remolding of 3 soil samples with cher chemical soil modification/stabilization (3 samples is equal to 1 unit) 		0	ea	\$90.30	
44.	Specific gravity test		0	ea	\$30.00	
45.	Unit weight determination		0	ea	\$14.25	
46.	Hydraulic conductivity test					
	a. Constant Head		0 -	ea	\$200.00	
	b. Falling Head		0	ea	\$235.00	
47.	Consolidation test		0	ea	\$340.00	
48.	Triaxial test					
	a. Unconsolidated - Undrained (UU)		0	ea	\$266.00	
	b. Consolidated - Undrained (CU)		0	ea	\$400.00	
	c. Consolidated - Drained (CD)		0	ea	\$580.00	
	d. Pore Pressure measurement with a. o and use of back pressure for saturation		0	ea	\$210.00	
49.	Soil support testing					
	a. California bearing ratio		0	ea	\$425.00	
	b. Subgrade resilient modulus		0	ea	\$360.00	
50.	Standard moisture-density relationship te	st	0	ea	\$100.00	
51.	Loss-on-ignition test		1	ea	\$17.25	\$17.25
52.	pH test		2	ea	\$11.55	\$23.10
53.	Collapse potential evaluation test		0	ea	\$300.00	
		GEOTECHNICAL ENGINE		eotechnic	cal Laboratory)	\$292.85
54.	Geotechnical profile and related work					
	a. Without soil subgrade drawings					
	First mile		0	LS	\$950.00	
	Each additional mile		0	mi	\$425.00	
	b. With soil subgrade drawings					
	First mile		0	LS	\$1,150.00	
	Each additional mile		0	mi	\$500.00	
	c. Soil subgrade drawings (only)					

			<u>Uni</u>	<u>t</u>	Unit Price	<u>Total</u>
	ii. Rental of support equipment and/or bo	pat cost plus 10%	0	1.1	\$0.00	\$0.00
	iii. Drill rig down time		0	hr	\$112.00	
	b. Non-navigable water barge set-up		0	ea	\$3,575.00	
16.	Additional disassembly and reassembly					
	a. Navigable water		0	ea	\$1,620.00	
	b. Non-navigable water		0	ea	\$1,420.00	
17.	Barge mounted borings with split spoon sam	pling	0	ft	\$24.15	
18.	Barge mounted core drilling		0	ft	\$32.00	
19.	Barge mounted boring through bedrock or bo	oulders	0	ft	\$38.00	
20.	Barge mounted soundings		0	ft	\$14.75	
21.	Casing through water		0	ft	\$6.40	
22.	Uncased sounding through water		0	ft	\$4.30	
23.	Set up for borings and machine soundings					
	a. Borings and machine soundings less that	n 20 ft deep	0	ea	\$52.00	
	b. Rock core borings less than 15 ft deep	·	0	ea	\$94.50	
24	Additional 2-in. split spoon sampling		0	ea	\$15.50	
25	3-in. split spoon samples		0	ea	\$17.25	
26	3-in. Shelby tube samples		0	ea	\$50.00	
27.	Bag samples					
	a. 300-lb sample		0	ea	\$85.00	
	b. 25-lb sample		0	ea	\$31.50	
28	Field vane shear test		0	ea	\$85.00	
29.	4½-in. cased hole		0	ft	\$9.50	
30.	Installation of Geotechnical Instruments					
	a. Inclinometer casing installation		0	ft	\$13.50	
	b. Piezometer installation up to 25 ft below s	surface	0	ea	\$225.00	
	c. Piezometer installation deeper than 25 ft	below surface	0	ea	\$320.00	
	d. Metal protective outer cover for inclinome		0	ea	\$95.00	
	casings	·				
31.	Geotechnical engineer		8	hr	\$82.00	\$656.00
32.	Railroad expenses	cost plus 10%	0	1.1	\$0.00	\$0.00
33.	Twenty-four hour water levels					
	a. Field measurements per borehole		0	ea	\$28.75	
	b. PVC slotted pipe		0	ft	\$4.60	
34	Special borehole backfilling					
	a. 10 to 30 ft					
	i. SPT		0	ea	\$83.00	
	ii. CPT		0 .	ea	\$35.00	
	b. More than 30 ft					
	i. SPT		0.0	ft	\$5.00	
	ii. CPT		0	ft	\$1.80	
	c. Pavement restoration		1	ea	\$42.00	\$42.00

INDIANA DEPARTMENT OF TRANSPORTATION DIVISION OF MATERIALS AND TESTS Geotechnical Section

REPORT OF FINAL COSTS FOR GEOTECHNICAL AND PAVEMENT INVESTIGATIONS BETWEEN INDOT AND CTL Engineering DATED 2/26/2004 IN ACCORDANCE WITH STATE WIDE GEOTECHNICAL INVESTIGATION.

DES NO: 8354420 PROJ NO: STP-4320 STR NO: N/A ROAD NO: SR 20 & SR 15

County: Elkhart

<u>Unit</u> **Unit Price** <u>Total</u> Mobilization and Field Coordination a. SPT Rig \$200.00 \$200.00 1 ea b. CPT 0 \$300.00 ea c. Field coordination with utilities LS \$230.00 \$230.00 d. Field coordination with property owners i. 1 - 10 0 LS \$300.00 ii. 11 - 25 0 LS \$430.00 iii. Over 25 0 LS \$580.00 e. Mileage 296 mi \$2.35 \$695.60 Truck mounted borings with split spoon sampling 60 ft \$14.60 \$876.00 2. Truck mounted borings with drilling fluid 0 ft \$14.75 3. Truck mounted core drilling 0 ft \$30.00 4. Truck mounted borings a. Truck mounted borings through bedrock or boulders or concrete pavement 0 ft \$25.00 b. Bridge deck coring and restoration 0 ea \$250.00 Cone penetrometer testing \$55.00 a. Set up 0 ea ft b. Subsurface profiling 0 \$10.30 c. Profiling with pore pressure measurement i. Piezometric Saturation 0 ea \$80.00 ft ii . Penetration \$11.50 iii. Pore water dissipation test hr \$190.00 iv. Hydraulic conductivity and consolidation ٥ ea \$66.00 d. Profiling with Shearwave Velocity Measurement n ft \$10.75 e. Sample n ea \$15.00 Hand or truck soundings ft \$9.35 7. n ft \$10.50 Hand auger drilling O 8. 0 ft \$22.00 Skid mounted borings with split spoon sampling 9. \$34.00 Skid mounted borings using drilling fluid 0 ft 10 11 Skid mounted core drilling n ft \$34.00 Skid mounted boring through bedrock or boulders ft \$34.00 12. Skid mounted soundings 0 ft \$13.15 14. Furnishing of a boat \$0.00 \$0.00 cost plus 10% 0 1.1 15. Barge set-up expenses a. Navigable water i. Barge set-up \$4,000.00 0 ea

INDIANA DEPARTMENT OF TRANSPORTATION

ITEMIZATION OF PAY QUANTITIES FOR INDOT SOIL BORINGS, REPORTS & PROFILES (TD-356)

SHEET: 1 OF. 1	STRUCTURE NO: SR 62 & 69	COUNTY: Eikhart	Shahid Siddiqui DATE: 1/24/06
INDOT			Shahi
FOR:	PROJECT NO: STP-4320		CHECKED BY:
CTI Engineering, Inc.		o Ti	Alebachew Tilahun
RY. CT! Fno.	DEC. 8354420	OCATION: SP 20 & SR 15 Inters	PREPARED BY:

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_			_	4			
ᆛ	a. S	hallow Foundation	_	_	_	2	7
	D.i.	First Mile			_		1
52	pH Test				7	2	2
21	Loss on Ignition				_		1
42	Plas	stic Limit			2	1	7
4	Liquid Limit		<u></u>		1	۳	-
40	Moisture Content		2	-	4	7	7
39				_	2	2	2
38			L		7	2	2
36			L		_		7
34	c. F	Pavement Restoration	_	~	-	-	-
31	Ge	otechnical Engineer				8	œ
2	Trı	uck Borings with SPT	6.10	6.10	6.10	18.30	0.08
	_	e. Mileage				296	206
<u>_</u>	lizatio	c. Field Coordination with Utilities					
	Mobi	c. Field Coordination with Utilities				+	1
		a. Equipment					
	Boring	o Z	TR.1	TB.5	7 a a	Total	* 040

* English



The Indiana Department of Transportation

Office of Geotechnical Engineering

120 South Shortridge Road P.O. Box 19389 Indianapolis, Indiana 46219-0389 Phone: (317) 610-7251 Fax: (317) 356-9351

Driving Indiana's Economic Growth

January 11, 2006

Mr. Gerald Mroczka, Chief Design Division N642 - IGCN

Attn:

Ms. Tamera Stoakes

Project Coordinator

Subject:

Subsurface Investigation – Addendum 2

Des No: 8354420

Project No: STP-4320 (7)

SR 15 from 0.34 Mi. S. of US 20 to 1.92 Mi. N. of US 20

County: Elkhart
District: Fort Wayne

Gentlemen:

The additional Geotechnical Investigation for the subject project has been completed and copies of the Geotechnical Report are being forwarded to those listed below.

If you have any questions concerning this matter, please call us.

Very truly yours,

Athar A. Khan.

Chief Geotechnical Engineer

There Morris

S. S. Horanay

Geotechnical Engineering Group Leader

SSH/SS

cc:

Mr. T. Seeman - Attn: Mr. W. Smith - Attachment

Mr. R. Alderman – Attn: Mr. J. Keefer – Attachment (2)

Mr. D. Cohen - Attachment

Ms. J. Somers - Attachment

Mr. J. Paauwe - Attachment

File

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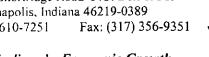


The Indiana Department of Transportation

Office of Geotechnical Engineering

120 South Shortridge Road P.O. Box 19389 Indianapolis, Indiana 46219-0389

Phone: (317) 610-7251



Driving Indiana's Economic Growth

Date: January, 10.2006

TRANSMITTAL:

го:	PROJECT: Addendum 2				
CTL Engineering Inc	Des No: 8354420				
6848 Hillsdale Court	Project No:STP-4320(7)				
Indianapolis, IN 46250	S.R. 15				
	County: Elkhart				
	Dist: Fort Wayne				

Gentlemen:

Please submit ten (10) copies of an addendum 2 for the Geotechnical report for the subject project. All ten (10) copies should be signed and sealed by the Approved Geotechnical Engineer. Also please send an itemization of pay quantities for this project.

The project will be considered completed when all of the above is received.

If you have any questions, please call us at our phone number (317) 610-7251 ext 220 or 219.

Very truly yours,

for Athar A. Khan, P.E.

Chief Geotechnical Engineer

Steve Monis

3,5 Hiremath, P.E.

Geotechnical Engineering Group Leader

SSH/jf cc: File

CTL Engineering of Indiana, Inc.

6848 Hillsdale Court, Indianapolis, Indiana 46250

Phone: 317/585-8277 • Fax: 317/585-8621

e-mail: ctlin@ctleng.com

AN EMPLOYEE OWNED COMPANY



Consulting Engineers • Testing • Inspection Services • Analytical Laboratories

Established 1927

January 10, 2005

Indiana Department of Transportation Materials and Tests Division 120 South Shortridge Road Indianapolis, Indiana 46219

Attention:

Mr. Athar Khan, P.E.

Chief Geotechnical Engineer

Reference:

Subsurface Investigation - Addendum 2

Des. No.: 8354420

Project No.: STP-4320(7)

SR 15 from 0.34 mi. S. of US 20 to a point 1.92 mi. N. of US 20

Elkhart County, Indiana

CTL Project No.: 05050045IND

Dear Mr. Khan:

CTL Engineering has completed the subsurface investigation on the above referenced site. Enclosed are ten (10) copies of the report.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

ah " Karah"

cc: Mr. Som Hiremath, P.E., INDOT - Materials and Tests Division

ITEMIZATION OF PAY QUANTITIES FOR INDITE SOIL BORINGS

1 of 1 62 & 69 Elkhart	January 6, 2006						
Sheet: Structure No.: 6 County:							
Indiana Department of Transportation STP-4320	cked By: Ali Karaki	a. Shallow Foundation b.i. First Mile by ph Test Loss on Ignition Plastic Limit Liquid Limit Moisture Content			4 1 2 1 2	7 1 2 1 2 1 2	7 1 2 1 2 1 2
Inc. For: Project:	Che	위 Hydrometer Analysis Sieve Analysis a. Flag Crew c. Pavement Restoration Geotechnical Engineer Truck Borings with SPT	6.10	6.10	6.10 2 2	18.30 8 1 1 2 2	60.0 8 1 1 2 2
By: CTL Engineering, Inc. Des. No.: 8354420 Location: SR 20 & 15 Intersectio	Prepared by: Randy Fladeland	e. Mileage C. Field Coordination with Utilities a. Equipment	TB-1	TB-2	TB-3	Total 1 1 1 296	Total * 1 1 296

* English

ITEMIZATION OF PAY QUANTITIES FOR INDITE SOIL BORINGS

		-			Н	
98						
1 of 1 62 & 69 Elkhart January 6, 2006				Ш	Ш	
1 of 62 & 69 Elkhart January		ļ		Ц	Ц	
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Z e		<u> </u>		\mathbb{H}		-
Sheet: Structure No.: County: Date:		-	Н	Н	Н	┝
				Н	Н	
<u> </u>						
Indiana Department of Transportation STP-4320 By: Ali Karaki 40 41 42 51 52 55 59	a. Shallow Foundation				2	7
ransp	Di. First Mile				1	1
t of T	pH Test			2	2	7
tmen i	Loss on Ignition				1	-
ana Depart -4320 Ali Karaki 41 42	Plastic Limit			2	2	2
ana D 2-432 Ali K	Liquid Limit	L			1	-
STE By:	Moisture Content	7	1	4	7	_
lnd ject: ST scked By:				2	2	7
For: Proje Chec		_		7	2	7
38		-	_		1	_
	c. Pavement Restoration	┢	-		1	-
	Geotechnical Engineer	L			8	8
lnc.	Truck Borings with SPT	6.10	6.10	6.10	18.30	60.0
CTL Engineering, Inc. 8354420 SR 20 & 15 Intersection Randy Fladeland	e. Mileage				296	296
Engin 420 0 & 1 y Fla	c. Field Coordination with Utilities					
CTL Eng 8354420 SR 20 & Randy Fl	c. Field Coordination with Utilities				-	-
	a. Equipment					-
By: Des. No.: Location: Prepared by:	No.	TB-1	B-2	TB-3	Total *	Total **
By: Des Pre		E	F	F	Ľ	F
	•					

** English *′ Metric



Indiana Department of Transportation

Materials and Tests Division

120 South Shortridge Road P. O. Box 19389 Indianapolis, Indiana 46219-0389 Phone: (317) 610-7251 Fax: (317) 356-9351

March 3, 2004

Mr. Gerald Mroczka, Chief Design Division N642 - IGCN

Attn: Ms.

Ms. Sally Chesney

Project Coordinator

Subject:

Subsurface Investigation - Addendum 1

Des No: 8354420

Project No: STP-4320 (3)

Proposed Storm Sewer Line, SR 15 Road Rehabilitation

County: Elkhart District: Fort Wayne

Gentlemen:

The additional Geotechnical Investigation for the subject project has been completed and copies of the Geotechnical Report are being forwarded to those listed below.

If you have any questions concerning this matter, please call us.

Very truly yours,

Athar A. Khan.

Chief Geotechnical Engineer

Somanath S. Hiremath

Geotechnical Engineering Group Leader

SSH/SS

cc:

Mr. T. Seeman - Attn: Mr. W. Smith - Attachment

Mr. D. Sturtz - Attn: Mr. J. Keefer - Attachment (2)

Mr. D. Cohen – Attachment

Ms. J. Somers - Attachment

Mr. J. Paauwe - Attachment

File

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SUBSURFACE INVESTIGATION ADDENDUM 1 DES. NO.: 8354420 PROJECT NO.: STP-4320 (3) PROPOSED STORM SEWER LINE SR 15 FROM 0.56 KM S. OF US 20 TO A POINT 3.10 KM N. OF US 20 ELKHART COUNTY CTL PROJECT NO.: 00-050061

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION MATERIALS AND TESTS DIVISION 120 SOUTH SHORTRIDGE ROAD INDIANAPOLIS, INDIANA 46219

PREPARED BY:

CTL ENGINEERING OF INDIANA, INC. 6848 HILLSDALE COURT INDIANAPOLIS, INDIANA 46250

FEBRUARY, 2004



CTL Engineering of Indiana, Inc.

6848 Hillsdale Court, Indianapolis, Indiana 46250

Phone: 317/585-8277 • Fax: 317/585-8621

e-mail: ctlin@ctleng.com

AN EMPLOYEE OWNED COMPANY



Established 1927

Consulting Engineers • Testing • Inspection Services • Analytical Laboratories

February 4, 2004

Indiana Department of Transportation Materials and Tests Division 120 South Shortridge Road Indianapolis, Indiana 46219

Attention:

Athar Khan, P.E.

Chief Geotechnical Engineer

Reference:

Subsurface Investigation - Addendum 1

Des. No.: 8354420

Project No.: STP-4320 (3) Proposed Storm Sewer Line

SR 15 from 0.56 km S. of US 20 to a point 3.10 km N. of US 20

Elkhart County

CTL Project No. 00-050061

Dear Mr. Khan:

In accordance with your authorization to proceed, CTL Engineering, Inc. has completed the subsurface investigation study on the above referenced site.

This addendum report includes the results of our field and laboratory testing, analyses and estimated soil parameters for the proposed storm sewer line.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office at (317) 585-8277.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

ali laisth

cc: Mr. Mr. Som Hiremath, P.E., INDOT - Materials and Tests Division

Offices: Ohio, Indiana, North Carolina, West Virginia

SUMMARY OF SUBSURFACE INVESTIGATION - ADDENDUM 1

The project is located on the west side of SR 15 between 283m (929') south of US 20 and 220m (722') north of US 20 in Elkhart County. The project involves design and construction of a new storm sewer line approximately 503m (1650') in length placed at depths of approximately 0.5m to 5.0m (2' to 16.5') beneath existing grade. The storm sewer will be 900mm to 1050mm in diameter.

A subsurface investigation for the subject project has been completed and a summary of our findings and recommendations is reported below. Detailed foundation recommendations and construction considerations are provided in the subsurface investigation report.

- 1. The test borings indicate that the underlying soil conditions are suitable for the construction of the proposed storm sewer line which would bear on sandy loam tills, and on sand at the outlet location.
- 2. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment.
- 3. The test borings indicated that groundwater or trapped water is contained in the sand seams or layers embedded within the till deposits.
- 4. Groundwater may be encountered in isolated locations depending upon the depth of the sand layers within the till deposits. Note that the test borings were drilled in October where the groundwater may have been at its lowest level. Therefore, the groundwater may be encountered at higher elevations depending upon time of construction and amount of precipitation. Dewatering in open cut excavations may be accomplished using a dewatering system suggested by the Contractor and approved by the engineer.
- 5. For open cut methods, excavations in excess of 4.0 feet in depth should be sloped and or shored according to OSHA requirements. Preliminary analysis indicates that excavations extending to the proposed invert elevations may be laid back at a slope rate no steeper than 3/4:1 (Horizontal to Vertical). If excavations cannot be sloped as recommended, the excavated sidewalls should be shored using a trench box system using the estimated soil parameters shown in Table 2 of the subsurface investigation report.
- 6. On-site excavated soils, except topsoil, are considered suitable for use for backfill provided proper moisture content is maintained during placement.
- 7. Pipe installation, trench width, bedding and backfill compaction should be performed in accordance with ISS.
- 8. Directional drilling should be possible at this site. Additional test borings may be needed to confirm the soil conditions.



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Subsurface Investigation Addendum 1 Proposed Storm Sewer Line

Des. No.: 8354420, Project No.: STP-4320 (3)

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PROJECT LOCATION AND DESCRIPTION I.

The project is located on the west side of SR 15 between 283m (929') south of US 20 and 220m (722') north of US 20 in Elkhart County, Indiana. The project involves the design and construction of a new storm sewer line between stations 10+117 and 10+620 for approximately 503m (1650'). The storm sewer will be 900mm to 1050mm in diameter.

Based upon the site plans provided by INDOT, the proposed storm sewer line will be constructed at invert elevations ranging from 260.95m at station 10+620 to 257.35 at station 10+117. Review of available X-sections for this project revealed that the storm sewer will be installed at depths of approximately 0.5m to 5.0m (2' to 16.5') beneath existing grade. We have assumed the storm sewer line will be constructed using conventional open cut excavation method. Also, we assumed directional drilling may be used where the storm line crosses US 20.

SUBSURFACE INVESTIGATION II.

Three (3) additional soil test borings, designated as SSL-1, SSL-2 and SSL-3, were drilled for this supplemental investigation at the locations shown on the enclosed test boring records. These test borings were drilled to depths ranging from 4.57m to 9.14m (15' to 30'). We have included in this report 5 borings that were drilled in 2001 for SR15/US20 roadway improvements and for a box culvert at station 10+122. These borings are designated as RB-3, RB-4, RB-5, TB-1 and TB-2,

The current test borings were advanced with an All-Terrain-Vehicle (ATV) mounted drilling machine utilizing hollow stem augers (HSA) on October 23, 2003. Standard Penetration tests were conducted using a 140-pound automatic hammer falling 30 inches to drive a 2inch O.D. split barrel sampler for 18 inches.

Drilling, sampling, field and laboratory testing have been performed according to standard geotechnical engineering practices, INDOT and current ASTM procedures. Results from field and laboratory tests are shown on the enclosed boring records and soil profile.

Soil samples obtained from the drilling operation were preserved in glass jars, visually classified in the field and laboratory. Representative soil samples were tested for natural moisture content, Atterberg limits, grain size distribution, unconfined compression and pH.

Locations and ground surface elevations of the test borings were interpolated from the site plans provided by INDOT.



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III. FINDINGS

The subsurface findings presented in this section are based upon the test borings drilled in 2003. The test borings drilled in 2001 are included in this report for additional information.

The test borings drilled along the proposed storm sewer line exhibited 3 to 12 inches (75 to 150mm) of topsoil at the surface.

Beneath the surface cover, SSL-1 through SSL-3 encountered mainly glacial till deposits described as sandy loam. Seams and/or layers of sand were encountered in isolated locations within the till deposits. TB-2 drilled near the proposed line outlet exhibited sand deposits throughout the drilled depth.

Standard penetration blowcount values ranged from 4 to 31 blows per foot (bpf) with natural moisture content values of 7 to 22 percent.

Groundwater and soil cave-in depths were recorded during the field investigation as shown in Table 1. Refer to the enclosed test boring records for information about the soils and groundwater encountered during this investigation.

Table 1 - Groundwater Level

<u> </u>	During	Drilling	At Cor	npletion	At 24-	Hours	Cave-in
Boring No.	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth
140.	(m)	(m)	(m)	(m)	(m)	(m)	(m)
RB-3	Dry		1.75	259.7	Dry		1.78
RB-4	0.91*	174.0*	2.51*	262.5*	0.91	264.1*	1.68
RB-5	Dry		Dry		Dry		2.29
TB-1	1.68	256.0	1.83	255.8	1.83	255.8	3.58
TB-2	1.83	255.2	1.52	255.5	0.91	256.1	1.22
SSL-1	Dry		Dry		Dry		
SSL-2	8.53	256.0	5.64	258.9	5.49	259.0	
SSL-3	3.96	258.5	1.68	260.8	1.52	261.0	2.44

^{*} Possible trapped water in gravel base due to rain or surface runoff



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IV. ANALYSIS AND RECOMMENDATIONS

The test borings indicate that the underlying soil conditions are suitable for the construction of the proposed storm sewer line. Generally, the storm sewer pipe would bear on sandy loam tills or sand at the outlet location. Based upon the above considerations and the soil data obtained from the field testing, the following recommendations are provided.

- 1. Excavation into the underlying soils to the proposed invert elevations may be accomplished using conventional excavation equipment. Generally, the soils at the proposed invert elevations of the pipe are expected to be medium stiff to stiff. However, due to removal of 16 feet of soil overburden, soft or loose soils may be encountered at or below the invert level in a form of soil swelling and/or liquefaction "boiling condition". In such an event, the soft/loose soils should be compacted or removed and replaced with suitable fill materials, or as otherwise directed by the Engineer.
- 2. The test borings indicated that groundwater or trapped water is contained in the sand seams or layers embedded within the till deposits. Based upon the groundwater levels observed during the field investigation and natural moisture content values of the recovered soil samples, groundwater may be encountered in isolated locations depending upon the depth of the sand layers within the till deposits. Note that the test borings were drilled in October where the groundwater may be at its lowest level. Therefore, the groundwater may be encountered at higher elevations depending upon time of construction and amount of precipitation. Dewatering in open cut excavations may be accomplished using sump pumps, well point system, or any dewatering system suggested by the Contractor and approved by the engineer.
- 3. For open cut methods, excavations in excess of 4.0 feet in depth should be sloped and or shored according to OSHA requirements. Preliminary analysis indicates that excavations extending to the proposed invert elevations may be laid back at a slope rate no steeper than 3/4:1 (Horizontal to Vertical).

The recommended slope rates may be modified during construction depending upon groundwater levels and sand deposits within the glacial tills. The excavated side slope should be observed and approved during construction by an experienced Registered Engineer.

If excavations cannot be sloped as recommended, the excavated sidewalls should be shored using a trench box system, or equivalent. The estimated soil parameters shown in Table 2 below may be used in designing the shoring system. The effects of surcharge loads from construction equipment, traffic and soil stockpiled adjacent to the excavated sidewalls should be considered in the design of the shoring system.



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Proposed Storm Sewer Line

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Table 2 – Estimated Soil Parameters for Shoring Design

Table 2 Estimated Son 1 at announce	l	Materials Typ	oe
Soil Parameters	In-place	Sand Loam	Sand/Sand
	Fill	(Till)	& Gravel
	120	135	125
Total Unit Weight, pcf (kg/m³)	(1925)	(2160)	(2000)
	0	3000	0
Undrained Shear Strength where $\emptyset = 0^{\circ}$, psf (kN/m ²)		(145)	0
6.1 1 1 1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2	0	600	0
Cohesion, psf (kN/m²)		(29)	0
Angle of Internal Friction (Ø), Degrees	30	25	32
At Rest Pressure, Ko	0.50	0.58	0.47
Active Pressure, Ka	0.33	0.41	0.31
Passive Pressure, Kp	3.00	2.46	3.25

- On-site excavated soils, except topsoil, are considered suitable for use for backfill provided proper moisture content is maintained during placement. A portion of the excavated soils may exhibit natural moisture content values above the optimum moisture. Such soils may require air-drying or other methods. Additional fill, if required, may consist of sandy silt, sand and gravel materials, flowable fill, or as otherwise directed by the Engineer.
- 6. Backfill materials should be placed and compacted in accordance with INDOT Standard Specifications. The engineered fill should not be placed in a frozen condition or over a frozen subgrade.
- 7. Pipe installation, trench width, bedding and backfill compaction should be performed in accordance with ISS.
- 8. Directional drilling should be possible at this site. Additional test borings may be needed to confirm the soil conditions in the area of the directional drilling operations are similar to those encountered in borings SSL-1 and SSL-2.



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CHANGED CONDITIONS V.

Should details of the proposed storm sewer line be changed from those used in preparing this report, CTL should be notified to make the necessary modifications in our recommendations to account for the changed conditions.

TESTING AND OBSERVATION VI.

Experience shows that underlying soil conditions in an area sometimes vary from the ones indicated in the borings at their specific locations. It is therefore recommended that a Soils Engineering Technician, under the supervision of a qualified Geotechnical Engineer, be retained on site to observe all excavations, soils at bottom of excavations and placement of backfill.

VII. **CLOSURE**

CTL has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analysis, conclusions and other work product of CTL are instruments of service for this project only.

Soil samples will be retained in our laboratory for 60 days, after which they will be discarded unless instructions are received from you as to their disposal.

CTL's assignment does not include, nor does this geotechnical report address, the environmental aspects of the particular site.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.

Ali Karaki, P.E.

Principal Engineer

Indiana Reg. No. 60900551

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EGISTEAN 900551 PROTES NOIAND

Paul L. Douglass, P.E.

Principal Engineer

Indiana Reg. No. 60012388

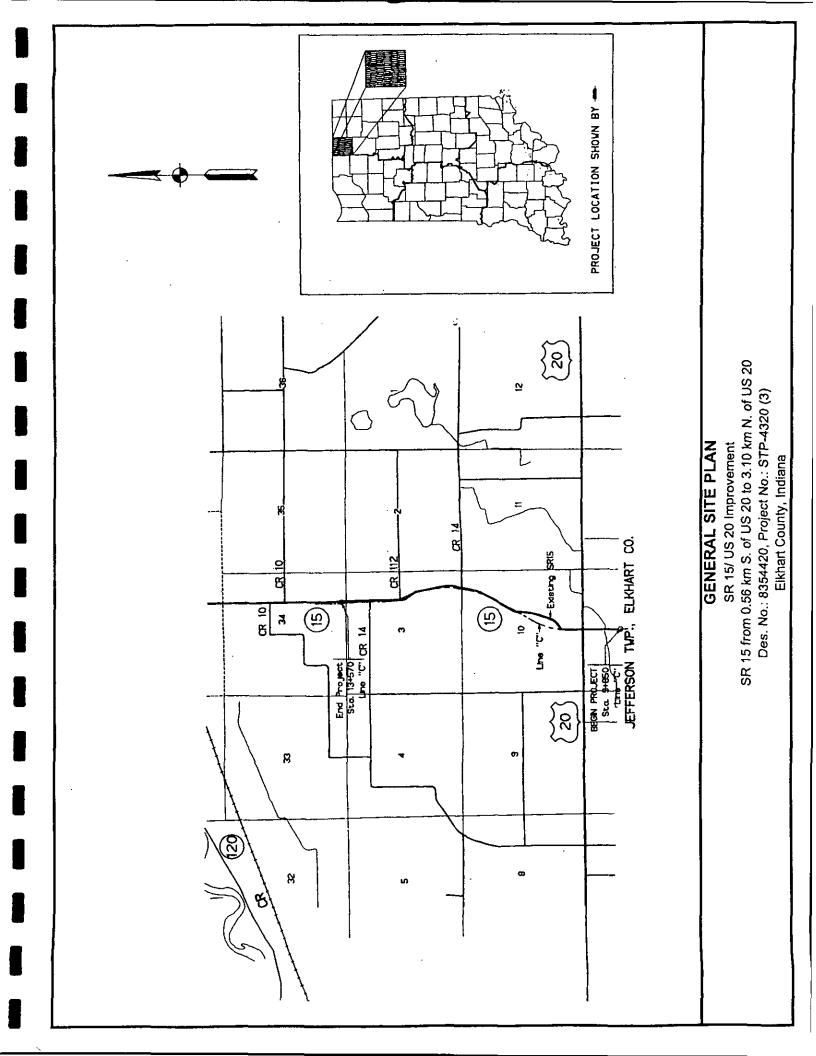
land L. Donglan



APPENDIX A

GENERAL SITE PLAN





APPENDIX B TEST BORING RECORDS



SOIL DESCRIPTION

NON-COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very Loose	6 - 10 11 - 30 31 - 50
COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOWCOUNTS PER FOOT (BPF)
Very SoftSoft Medium Stiff Stiff Very StiffHard	
GRADATION COMPONENT	SIZE
Boulders	assing 8" Retained on 3" ssing 3" Retained on #10 ing #10 Retained on #40 on #40 Retained on #200 . 0.075 mm to 0.002 mm
MOISTURE TERMS	DESCRIPTION
Dry Slightly Moist Moist Abo Very Moist Wet	Below Plastic ve Plastic, Below Liquid At Liquid



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BORIN	G ELE	EVATION: 262.5 m USC&GS	BORING ME	THOD	: HSA				HAI	MMER	:	Autom	atic	
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Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	N	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	A	tterbe Limits	rg ;
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262.35_		TOPSOIL (150mm) (Visual)		0.15										
		Brown, Slightly Moist, Medium Stiff to Very Stiff, SANDY LOAM with Gray Streaks in S	, SS-2		SS-1	4 4 6	10	100	13			22	12	10
	1.5	A-4 (1) Lab 1			\$ \$-2	5 8 11	19	100						
260.67_	- X			1.83	SS-3	5 7 9	16	100	11			22	12	10
	3.0/	Brown Changing to Gray, Damp, Very Stiff Stiff, SANDY LOAM (TILL)	fto		SS-4	5 7 10	17	100	11	2235	383 @ 15.0%			;
	4.5	A-4 (1) Lab 2			SS-5	4 6 7	13	100	12					
257.32_ 257.01_	<u> </u> X	Gray, Moist, Medium Stiff, CLAY LOAM (Visual)		5.18 5.49	SS-6	5 3 5	8	100	22	:				
		Bottom of Boring at 5.14 meters (18')												
	6.0	NOTES												
		Temporary slotted PVC pipe set at 18 f Boring backfilled with soil cuttings.	eet											
 	<u> </u>	CTL Engineering of Indiana, Inc.	BORING	METH	OD	s	AMPLI	NG M	THO)	ABBR	REVIA	TIONS	 ;
_	,	■ 6848 Hillsdale Court	HSA - Hollo		-	ı	- Split						etrom	eter
		Indianapolis, Indiana 46250	SFA - Solid RC - Rock		uger	ST	- Shel				•	uid Lin stic Li		
ENGINE	ERING #	Phone: 317-585-8277	MD - Mud I	Drilling		BS	- Bag	Samp	le .	PI	- Pla	sticity	Index	
		Fax: 317-585-8621	WD - Wast	-	ı	AC	- Aug	er Cuti	ings	SF	Per Sta		on Tes	c†

TEST BORING RECORD CLIENT : Indiana Department of Transportation BORING NO.: SSL-2 PROJECT : Proposed Storm Sewer Line SHEET 1 OF :_10-23-03 LOCATION : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co. DATE STARTED : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. DATE COMPLETED: 10-24-03 BORING ELEVATION: 264.5 m USC&GS BORING METHOD: HSA HAMMER : Automatic STATION : 10+473 **RIG TYPE** : CME 55 Truck DRILLER : TN **OFFSET** 15 m Lt TEMPERATURE: High 60's ° F CASING DIA. : 83 mm LINE "B" DEPTH 2.79 m CORE SIZE WEATHER : Cloudy ▼ At Completion <u>5.64 m</u> GROUNDWATER: Encountered at 8.53 m 24 hours Reading 5.49 m 💆 Caved in at <u>m</u> Total Unit Weight (kg/m³) Unconfined Compression (kN/m²) Moisture Content (%) E Atterberg Recovery (%) Stratum Elevation Limits **SOIL/MATERIAL DESCRIPTION** Stratum Depth SPT/ 30 Sample Depth E PL ΡI TOPSOIL (150mm) (Visual) 0.15 264.35 SS-1 3 10 100 11 6 569 SS-2 7 17 100 11 2120 @ 11.1% 10 5 Brown, Slightly Moist, Medium Stiff to Very SS-3 7 18 67 Stiff, SANDY LOAM (TILL) with Sand Seams in SS-4 11 A-4 As Lab 2 3 SS-4 5 12 67 12 3.0 260.23 4.27 SS-5 3 13 100 4.5 10 Gray, Slightly Moist to Moist, Medium Stiff to Hard, SANDY LOAM (TILL) A-4 As Lab 2 SS-6 3 7 100 19 6.0 Continued on next page SAMPLING METHOD CTL Engineering of Indiana, Inc. **BORING METHOD ABBREVIATIONS** HSA - Hollow Stem Auger - Split Spoon Sample - Hand Penetrometer 6848 Hillsdale Court SFA - Solid Flight Auger ST - Shelby Tube Sample - Liquid Limit Indianapolis, Indiana 46250 RC - Rock Coring CR - Rock Core Sample PL - Plastic Limit - Bag Sample MD - Mud Drilling BS ы - Plasticity Index Phone: 317-585-8277 WD - Wash Drilling AC - Auger Cuttings SPT - Standard Fax: 317-585-8621 HA - Hand Auger Penetration Test

		TES	T BORI	NG	REC	ORD)							
CLIEN	т	: Indiana Department of Transportation					_		воя	RING NO	D.:	SSI	L- 2	
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255.51 255.36	9.0	Brown, Wet, Medium Dense, SAND (Visual) Gray, Wet, Very Stiff, SANDY LOAM (TILL (Visual) Bottom of Boring at 9.14 meters (30')		8.99 9.14	SS-8	5 7 15	22	100	12				. :	
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	12.0												:	
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Ż	71.5 <u> </u>	W	Brown Changing to Brownish Black, Moist, Medium Stiff, SANDY LOAM with Traces of Organics (Possible Fill) (Visual)	-			SS-2	5 5	9	33	20					
260.52_	-	N	Brown, Moist, Medium Stiff, SANDY LOAM A-4			1.98	SS-3	4 3 4	7	100	7					
259.91	_	\prod	As Lab 1			2.59		1		ŀ						
259.60 __	3.0	M	Brown, Wet, Very Loose, SAND (Visual)		11	2.90	SS-4	1 3	4	44						
<u></u>	-		Brown, Wet to Moist, Soft to Stiff, SANDY LOAM A-4 As Lab 2													
	4.5	M					SS-5	4 8 5	13	100						
257.93_		Н	Bottom of Boring at 4.57 meters (15.0')	<u> </u>		_4.57		5	1							ļ
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	-															:
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		-									:					:
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L		5	Indianapolis, Indiana 46250	RC - R		_		CR BS	- Roc - Bag			ple Pl		stic Li sticity		ť
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I			Fax: 317-585-8621			Δυσος		1	_			- 1	Pai	netrati	on Te	st

Test Boring Records drilled in 2001 Within the Limits of the Proposed Storm Sewer Line



TEST BORING RECORD BORING NO.: RB-3 CLIENT : Indiana Department of Transportation SHEET 1 OF : SR 15/US 20 Improvement **PROJECT** DATE STARTED : 05-15-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-15-01 : 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. **BORING METHOD: HSA** HAMMER : Automatic BORING ELEVATION: 261.40 m (USC&GS) **STATION** 10+240 DRILLER : KO : CME 55 Truck **RIG TYPE** 10 m Rt **OFFSET** TEMPERATURE: 70° F CASING DIA. : 83 mm "C" LINE WEATHER : Sunny **CORE SIZE** 2.29 m DEPTH Y At Completion 1.75 m ■ Caved in at 1.78 m Encountered at Dry GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) Atterberg SPT/ 30 cm SPT / 15cm Total Unit Weight (kg/m²) Recovery (%) Stratum Elevation Limits Sample Number SOIL/MATERIAL DESCRIPTION Stratum Depth Ê Sample Depth ΡI PL 0.15 TOPSOIL (152 mm) (Visual) 261,25 5 Brown, Moist, Loose, SANDY LOAM with 5 16 **SS-1** 10 89 Traces of Roots 5 A-4 As Lab 3 0.76 260.64 3 \$\$-2 3 7 100 4 Brown, Slightly Moist, Medium Stiff to Very Stiff, SANDY CLAY LOAM A-4 (0) Lab 1 6 18 11 7 **SS-3** 9 19 100 10 2.29 10 259.11 Bottom of Boring at 2.29 meters Boring backfilled with soil cuttings. 3.0 4.5 6.0 ABBREVIATIONS SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer - Split Spoon Sample SS HSA - Hollow Stem Auger 6330 East 75th Street, Suite 178 - Shelby Tube Sample - Liquid Limit ST SFA - Solid Flight Auger - Plastic Limit PL CR - Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring ы - Plasticity Index BS - Bag Sample MD - Mud Drilling Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings WD - Wash Drilling Penetration Test Fax: 317-585-8621 HA - Hand Auger

TEST BORING RECORD BORING NO.: RB-4 : Indiana Department of Transportation CLIENT SHEET 1 OF **PROJECT** : SR 15/US 20 Improvement DATE STARTED : 06-20-01 : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 06-20-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. HAMMER : Automatic BORING ELEVATION: 265.00 m (USC&GS) BORING METHOD: HSA : 10+360 DRILLER : KO **STATION** : CME 550 ATV **RIG TYPE** 10 m Rt **OFFSET** TEMPERATURE: 80° F CASING DIA. : 83 mm LINE "C" WEATHER : Sunny **CORE SIZE** 3.05 m DEPTH E Caved in at 1,68 m At Completion 2.51 m Encountered at 0.91 m GROUNDWATER: Unconfined Compression (kN/m²) Moisture Content (%) Ê Atterberg SPT / 15cm Recovery (%) Total Unit Weight (kg/m³) Limits SPT/ 30 c (N) Stratum Elevation SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Sample Depth LL PL PI 0.15 GRAVEL (Fill) (152 mm) (Visual) 264.85 7 Gray, Moist, Loose, SANDY LOAM SS-1 5 7 78 15 A-4 2 As Lab 3 0.76 264.24 2 **SS-2** 2 7 94 18 5 Brown with Gray Streaks, Moist, Medium Stiff to Stiff, SANDY CLAY LOAM 1.5 A-4 As Lab 1 4 6 100 **SS-3** 15 9 2.29 262.71 Brown, Slightly Moist, Stiff, LOAM 7 SS-4 5 12 100 As Lab 5 7 3.0 3.05 261.95 Bottom of Boring at 3.05 meters Boring backfilled with soil cuttings. NOTE: The 24-hours groundwater reading may be due to rain accumulated in the borehole. 4.5 6.0 ABBREVIATIONS **BORING METHOD** SAMPLING METHOD CTL Engineering of Indiana, Inc. - Hand Penetrometer HSA - Hollow Stem Auger - Split Spoon Sample 6330 East 75th Street, Suite 178 LL Liquid Limit - Shelby Tube Sample ST SFA - Solid Flight Auger Plastic Limit CR - Rock Core Sample Indianapolis, Indiana 46250 RC - Rock Coring ы - Plasticity Index MD - Mud Drilling - Bag Sample BS Phone: 317-585-8277 SPT - Standard AC - Auger Cuttings WD - Wash Drilling Penetration Test Fax: 317-585-8621 - Hand Auger HA

		-		TES	T BC	RII	NG I	RECC	ORD	1				-			
CLIENT	-	: Indiana	Department of Transpo	ortation						_		BOF	RING NO	.:	RB	-5	
PROJE		: SR 15/	US 20 Improvement									SHE	ET	1	0	=	1
LOCAT			from 0.56 km S. to 3.10	km N of U	S 20 in E		rt Coun	tv		-		DAT	E STAR	TED	: 05-1	5-01	
DES N			20, Project No.: STP-432					-		-		DAT	E COMF				
			: 264.50 m (USC&GS)		BORING			· HSA				Т	MER		utoma		
BORIN		TION	: 10+480		RIG TY			: CME 5	5 Truc				LLER	: <u>·</u>			
ļ	OFF		: 5 m Rt	ļ						<u> </u>		.]	IPERATI				
	LINE		: <u>"C"</u>		CASING			: <u>83 mm</u>				. !	ATHER	-			
	DEP		: 3.05 m		CORE S			: 17					KINEK		Sunny	- 10	
GROUI	NDWAT	ER: ¥	Encountered at <u>Dry</u>		At Comp	letion	Dry	_	24 hou	irs Kea	aaing	DIĀ			aved ir	at <u>2.</u>	<u></u>
Stratum Elevation	Sample Depth		SOIL/MATERIAL DE	SCRIPTION	I		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)	· ·	terbei Limits	;
कृष्	ဇိဒ					XXX	ωū	ΰŻ	S	S	<u>~</u>	Συ	F53	⊃ U	LL	PL	Pl
264.14		ASPHA	LT CONCRETE (356 mn	n) (Visual)		\bowtie	0.36										
263.59		Gray ch Medium A-4 As Lab	nanging to Brown, Slightl n Dense, SANDY LOAM 3	ly Moist,			0.91	SS-1	6 8 5	13	100	13					
	1.5							SS-2	3 6 10	16	67	11		:			
1		Brown Stiff, LC A-4 As Lab	with Gray Streaks, Slight DAM (TILL) 5	tly Moist, Ve	ЭГУ			SS-3	4 7 10	17	100			• :			;
261.45	3.0	Bottom	of Boring at 3.05 meter	rs			3.05	SS-4	3 7 9	16	100	:					
			backfilled with soil cuttin ent restored with concret														
	4.5																
	6.0_																
 	<u></u>	CTL	Engineering of Indian	na, Inc.			G METI			AMPL					REVIA		
ENGINE	ERING	6330 India Phor	D East 75 th Street, Suinapolis, Indiana 4625 ne: 317-585-8277	ite 178	HSA - SFA - RC - MD - WD -	Solid Rock Mud Wast	Flight A Coring Drilling h Drillin	Auger g	SS ST CR BS AC	- Spli - She - Roc - Bag - Aug	iby Tu k Core Samp	be Sa Sam ble	mple Ll ple Pl Pl	- Liq L - Pla I - Pla PT - Sta	nd Per uid Lin istic Li isticity indard netrati	nit mit Index	

CLIENT Indiana Department of Transportation SHE I		•				TES	TBO	ORI	NG I	RECO	RD)							
PROJECT : SR 15/US 20 Improvement LOCATION : SR 15 from 0 56 km S. to 3 10 km N. of US 20 in ERhant County DATE STARTED : 0.52.201 DATE STARTE	CLIENT	-		Indiana	Department of Transpo	ortation								BOF	RING NO	D.:	TB	-1	
DCATION SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Exhant County DATE STARTED D5-22-01	i				<u> </u>			_				_		SHE	EET	1			1
DESINO 8354420, Project No.: \$TP-4320 (3), CTL No.: 00-360061 DATE COMPLETED: 05-22-01	l					km N. of U	IS 20 in	Elkhaı	rt Coun	ty		_		DAT	E STAF	TED			_
BORING SELEVATION 25765 m (USC&GS) BORING METHOD HSA HAMMER H												_		DAT	TE COM				
STATION 191218										: HSA									
OFSET LINE 20 m Rt	}										5 Truc	k		DRI	LLER	: F	(O		
Core Size Sunny				ET			CASIN	IG DIA						TEN	MPERAT	_			
Carrel C				тн			}			•				·					
SOILMATERIAL DESCRIPTION Fig. F	GROUI			-		Ā			1.83 r	n 🔽	24 hou	ırs Rea	ading	1.83 n	1	頑 C	aved in	1 at <u>3.</u> 5	58 m
TOPSOIL (457 mm) (Visual)	<u> </u>		1								T	1	<u> </u>			_ <u>_</u>	<u> </u>		
257.19 TOPSOIL (457 mm) (Visual)	atum vation	nple th			SOIL/MATERIAL DE	SCRIPTION	N		atum oth	nple mber	T / 15cm	T/ 30 cm (N)	covery %)	isture ntent (%)	tal Unit light /m³)	confined mpressic kN/m²)	A	terber Limits	·g
257.19 Black to Dark Gray, Moist, Very Loose, AA4	Stra	Sar							Str	Sar	S P	S S	§)	နိပိ	Σ ¥ ₹	58	LL	PL	PI
Black to Dark Gray, Molst, Very Loose, SAND	257.19_	_		TOPSO	L (457 mm) (Visual)				_0.46	:									
256.13 1.5 Black to Dark Gray, Moist, Loose, SAND A-1-b As Lab 4 1.98 SS-3 5 9 67 3.0 Brownish Gray, Wet, Medium Dense, SAND (Visual) 253.08 4.5 Bortion of Boring at 4.57 meters Boring backfilled with soil cuttings. Dozer used to pull drilling rig. CTL Engineering of Indiana, Inc. 6330 East 75° Street, Suite 178 Indianapolis, Indiana 46250 RC - Rock Corong MD - Mud Drilling MD - Mud Drilling BS - Bag Sample Phone: 317-585-8277 W. Wash Drilling MC - Mud Critings BS - Bag Sample Phone: 317-585-8277 W. Wash Drilling MC - Mud Drilling BS - Bag Sample PI - Plastic Limit PI - Plasticity Index ST. Sandard ST. St		-	\bigvee	Black to	Dark Gray, Moist, Very	Loose,				SS-1	2	3	94	28				!	
255.67. Silack to Dark Gray, Moist, Loose, SAND		_	$ \sqrt{} $	A-4						SS-2	1	2	67						
Black to Dark Gray, Moist, Loose, SAND A-1-b A-1-b A-1-b As Lab 4 1.98 SS-3 5 9 67 3.0 Brownish Gray, Wet, Medium Dense, SAND (Visual) SS-4 5 111 67 Brownish Gray, Wet, Medium Dense, SAND (Visual) SS-5 8 21 89 1.3 21 89 CTL Engineering of Indiana, Inc. Boring backfilled with soil cuttings. Dozer used to pull drilling rig. SS-5 8 9 67 A.57 SS-5 8 21 89 CTL Engineering of Indiana, Inc. 630 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 BRORING METHOD SAMPLING METHOD ABBREVIATIONS HSA - Hollow Stem Auger SS - Split Spoon Sample CR - Rock Core Sample	256.13	1.5	H						1.52		'								
As Lab 4]	_	Ц		Dark Gray, Moist, Loos	se, SAND					١,								
SS-4 5 11 67 Brownish Gray, Wet, Medium Dense, SAND (Visual) SS-4 5 11 67 Brownish Gray, Wet, Medium Dense, SAND (Visual) SS-5 8 21 89 SS-6 8 21 89 SS-7 8 8 21 89 SS-7 8 8 21 89 SS-7 8 8 21 89 SS-7 8 8 8 21 89 SS-7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	255.67	-	M		4			· · · · ·	1.98	SS-3		9	67						
253.08 4.5 Bottom of Boring at 4.57 meters Boring backfilled with soil cuttings. Dozer used to pull drilling rig. CTL Engineering of Indiana, Inc. 6.0		3.0_	X			· Dense , SAN	D			SS-4	5	11	67						
CTL Engineering of Indiana, Inc. 6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 BORING METHOD SAMPLING ME	253.08_	4.5_	X			nt.			4.57	SS-5	8	21	89						
CTL Engineering of Indiana, Inc. 6330 East 75th Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 Dozer used to pull drilling rig. BORING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD SAMPLING METHOD ST. Shelby Tube Sample ST. Shelby Tube Sample CR. Rock Coring MD. Mud Drilling MD. Mud Drilling MD. Mud Drilling MD. Wash Drilling WD. Wash Drilling WD. Wash Drilling WD. Wash Drilling WD. Sample ST. Shelby Tube Sample BS. Bag Sample PL. Plastic Limit PI. Plasticity Index SPT. Standard		-	$\ \ $		_														
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6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 HSA - Hollow Stem Auger SFA - Solid Flight Auger RC - Rock Coring MD - Mud Drilling WD - Wash Drilling WD - Wash Drilling WD - Auger Cuttings SS - Split Spoon Sample ST - Shelby Tube Sample CR - Rock Core Sample BS - Bag Sample PI - Plasticity Index SPT - Standard		••_	11																
6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 HSA - Hollow Stem Auger SFA - Solid Flight Auger RC - Rock Coring MD - Mud Drilling WD - Wash Drilling WD - Wash Drilling WD - Auger Cuttings SS - Split Spoon Sample ST - Shelby Tube Sample CR - Rock Core Sample BS - Bag Sample PI - Plasticity Index SPT - Standard		-	$\ \ $																
6330 East 75 th Street, Suite 178 Indianapolis, Indiana 46250 Phone: 317-585-8277 HSA - Hollow Stem Auger SFA - Solid Flight Auger RC - Rock Coring MD - Mud Drilling WD - Wash Drilling WD - Wash Drilling WD - Auger Cuttings SS - Split Spoon Sample ST - Shelby Tube Sample CR - Rock Core Sample BS - Bag Sample PL - Plastic Limit PI - Plasticity Index SPT - Standard		<u> </u>	ш	CTI	Engineering of Indian	a Inc	В	ORING	METH	IOD	s	I AMPLI	NG M	I ETHOI		ABB	I	L TIONS	<u> </u>
Indianapolis, Indiana 46250 RC - Rock Coring RD - Mud Drilling RD - Mud Drilling RD - Mud Drilling RD - Mud Drilling RD - Auger Cuttings RD - Auger Cuttings RD - Standard	l _				-		HSA -	Hollov	w Stem	Auger	SS	- Split	Spoo	n Sam	iple *	- Hai	nd Per	etrom	
## Phone: 317-585-8277		1		7						Auger	L					•			
WD - Wash Drilling AC - Auger Cuttings SPT - Standard	ENGINE	ERING	Į		•		MD -	Mud [Drilling		BS	- Bag	Samp	le	P	i - Pla	sticity	Index	
			-							3	AC	- Aug	er Cut	tings	s	-			st

TEST BORING RECORD BORING NO.: TB-2 : Indiana Department of Transportation CLIENT SHEET OF : SR 15/US 20 Improvement **PROJECT** : 05-11-01 DATE STARTED : SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart County LOCATION DATE COMPLETED: 05-11-01 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061 DES NO. HAMMER : Automatic BORING METHOD: HSA BORING ELEVATION: 257.00 m (USC&GS) **STATION** : 10+126.5 DRILLER **RIG TYPE** : CME 55 Truck : KO 20 m Lt **OFFSET** TEMPERATURE: 70° F CASING DIA. : 83 mm "C" LINE WEATHER : Sunny **CORE SIZE** DEPTH 6.10 m At Completion 1.52 m 24 hours Reading 0.91 m Caved in at 1.22 m GROUNDWATER: Encountered at 1.83 m 5 Unconfined Compression (kN/m²) Moisture Content (%) Atterberg SPT / 15cm Total Unit Weight (kg/m³) Recovery (%) Limits Stratum Elevation SPT/30 SOIL/MATERIAL DESCRIPTION Stratum Depth Sample Number Ê Sample Depth LL PL ы 3 TOPSOIL (305 mm) (Visual) **SS-1** 2 67 21 0.46 256.54 2 Dark Gray to Black, Moist, Very Loose, SAND with Little Roots (Visual) 0.76 256.24 8 SS-2 24 31 72 7 6 6 72 **SS-3** 12 6 8 SS-4 10 89 18 3.0 8 Brownish Gray, Wet, Dense to Loose, SAND with Bouldery Zone at 1.52 m (Visual) 25 gallons of water was used to keep sand from heaving at 4.57 m 3 **SS-5** 4 9 83 5 8 SS-6 3 8 100 6.0 5 6.10 250.90 Bottom of Boring at 6.10 meters Continued on next page **ABBREVIATIONS** SAMPLING METHOD **BORING METHOD** CTL Engineering of Indiana, Inc. - Hand Penetrometer HSA - Hollow Stem Auger - Split Spoon Sample 6330 East 75th Street, Suite 178 - Shelby Tube Sample LL - Liquid Limit SFA - Solid Flight Auger ST - Plastic Limit Indianapolis, Indiana 46250 - Rock Core Sample PL RC - Rock Coring CR - Bag Sample MD - Mud Drilling - Plasticity Index BS Phone: 317-585-8277 WD - Wash Drilling AC - Auger Cuttings SPT - Standard Fax: 317-585-8621 Penetration Test HA - Hand Auger

		TES	T BORII	NG F	RECO	RD								
CLIENT	BOF	ING NO	:	ТВ										
PROJE		: SR 15/US 20 Improvement			· · · · · · · · · · · · · · · · · · ·			- 1	SHE	ET_	2	O	- 2	2
Stratum Elevation	Sample Depth	SOIL/MATERIAL DESCRIPTION	:	Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m³)	Unconfined Compression (kN/m²)		terber Limits	
Str	Sar			<u> </u>	ะรั้	S	S	ž	Σŏ	<u> </u>	ΞŬ	LL	PL	PI
	7.5	Boring backfilled with soil cuttings.												
	9.0													
	10.5									<u>.</u>				
	12.0				Brest Control of the									
	13.5	CTL Engineering of Indiana, Inc.	BORIN				AMPL						TIONS	
1		CTL Engineering of Indiana, Inc.	HSA - Hollo				- Spli						netron	



6330 East 75th Street, Suite 178 Indianapolis, Indiana 46250

Phone: 317-585-8277 Fax: 317-585-8621

SFA - Solid Flight Auger

RC - Rock Coring
MD - Mud Drilling
WD - Wash Drilling
HA - Hand Auger

PL

 Liquid Limit
 Plastic Limit - Plasticity Index

SPT - Standard Penetration Test

SR_15_00-5061.GPJ_CTLMET.GDT

			TE	ST B	ORIN	NG F	RECO	RD								
CLIENT		Indiana Depart	ment of Transportation						_		BOF	ING NO	.:	ТВ	-3	
PROJE		SR 15/US 20 I							_		SHE	ET	1_	_ 01	= <u> </u>	1
LOCAT	ION	SR 15 from 0.5	66 km S. to 3.10 km N. o	f US 20 in	Elkhar	t Count	у		_		DAT	E STAR	TED	05-2	2-01	
DES NO	D	8354420, Proje	ect No.: STP-4320 (3), C	TL No.: 00	-05006	1					DAT	E COMP	LETED	05-2	2-01	
BORING		ATION : 258.1		BORIN	IG MET	HOD :	HSA				HAN	MER	_	utoma	tic	
Ì	STA			_ RIG T	YPE	:	CME 5	5 Trucl	(1	LER	: <u> </u>			
	OFF:		KI	CASIN	ig dia.	:	83 mm				TEM	IPERATI	JRE : <u>7</u>	5° F		
	DEP			CORE								ATHER		unny		
GROU	DWATE	R: I Encoun	tered at <u>Dry</u>	At Com	pletion	Dry	<u>¥</u> :	24 hou	ırs Rea	ding	Dry		. πā Ca	aved in	at <u>4.2</u>	27 m
Stratum Elevation	Sample Depth	soll	∟/MATERIAL DESCRIPTI	ION		Stratum Depth	Sample Number	SPT / 15cm	SPT/ 30 cm (N)	Recovery (%)	Moisture Content (%)	Total Unit Weight (kg/m²)	Unconfined Compression (kN/m²)		terber Limits	
ΩШ	SΩ		<u> </u>			6 , L	0,2				-		-			
		Dark Gray, Moi Little Traces of	st, Very Loose, SAND wi Roots (Visual)	ith			SS-1	2 1 1	2	67			:			
256.93_						1.22	SS-2	2 2 4	6	56			į			
	1.5						SS-3	3 2 2	4	67						
	3.0	Brown, Moist to SANDY CLAY I 2.44 m (Visual)	o Very Moist, Loose, SAN LOAM between 1.98 m a	ND with and			SS-4	3 3 2	5	89						
253.58 ₁	4.5	Bottom of Bori	ing at 4.57 meters			4.57	SS-5	2 2 3	5	89						
	6.0_	Boring backfille	ed with soil cuttings.													
							100	 _	ABSDI	L L	ETUO		ADD	SEATA	 TIONS	<u> </u>
			eering of Indiana, Inc.		ORING - Hollo		Auger	SS	- Spli		n San		- Ha	nd Pe	netron	
	411		75 th Street, Suite 178	SFA	- Solid	Flight A	Auger	ST	- She	lby Tu	be Sa	mple L		uid Lir istic Li		
		· ·	s, Indiana 46250		RockMud i	-		CR BS	- Roo	k Core Samı		ple P P			mii Index	
ENGINE	ERING #	Phone: 317		WD	- Wash	n Drillin	-	AC		er Cu		s	PT - Sta			-+
1		Fax: 317-58	85-862T	HA.	 Hand 	Auger							Pe	netrati	on Te	ડા

APPENDIX C

LABORATORY TEST RESULTS

Summary of Classification Test Results
Grain Size Distribution Curves
Unconfined Compression Test Results
Summary of Special Laboratory Test Results



WC LL PL PI Density Content @ @	%26		
CBR @	93%		
ture	į (
Optin Moist	8		
Dry	દ		
Max. Den	ğ		
<u>o.</u>		10	10
<u> </u>		12	12
<u> </u>		3 22	1 22
_ }	зу	.7 1	5.
outio	Ö	4 15	1 17
Jistril ۱)	Sil	26.	28.
Size Di (%)	Sand	49.4	46.9
Percent Passing Grain Size Distribution (Sieve No.)	10 40 200 Gravel Sand Silt Clay	8.5	7.5
ssing o.)	200	42.1	45.6
nt Pa ive N	40	73.3	76.0
Percent Passir (Sieve No.)	10	91.5	92.5
0	dnoib	LOAM A-4 (1) 91.5 73.3 42.1 8.5 49.4 26.4 15.7 13 22 12 10	A-4 (1)
Soil	Classification	SANDY LOAM	Lab 2 SSL-1 10+293 15 m Lt "B" SS-3 1.83-2.29 SANDY LOAM A-4 (1) 92.5 76.0 45.6 7.5 46.9 28.1 17.5 11 22 12 10
Depth		Lab 1 SSL-1 10+293 15 m Lt "B" SS-1 0.30-0.76 SANDY	1.83-2.29
Sample	o Z	SS-1	SS-3
Line		ā	"B"
Offset Line Sample		15 m Lt	15 m Lt
		10+293	10+293
Lab Boring Station	j Ž	1 SSL-1	2 SSL-1
Lab	j Z	Lab	Lab:

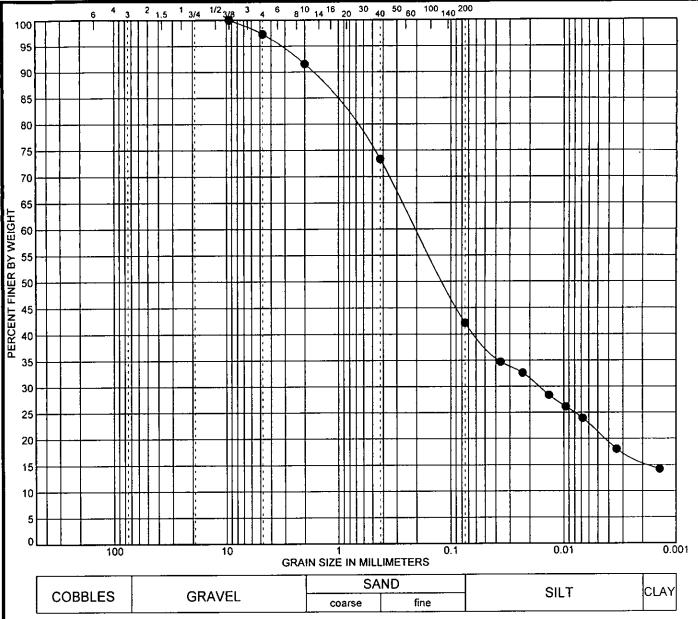
SUMMARY OF CLASSIFICATION TEST RESULTS

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Project No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061





Boring No.	SSL-1		(Classificati	MC	LL	PL	PI	Сс	Cu		
Sample	SS-1		S		13	22	12	10				
Depth	0.30-0.76			A-4(1)								
Station	10+293		Lab 1									ļ
Offset	15 m Lt						<u> </u>		ļ			<u> </u>
Line	"B"											<u> </u>
Remarks		D100	D60	D50	D30	D10	%Grav	el %	Sand	%Si	lt %	6Clay
		9.5	0.202	0.116	0.017		8.5		49.4	26.4	1	15.7
							_					
							1					



CTL Engineering of Indiana, Inc. 6848 Hillsdale Court

Indianapolis, Indiana 46250 Phone: 317-585-8277

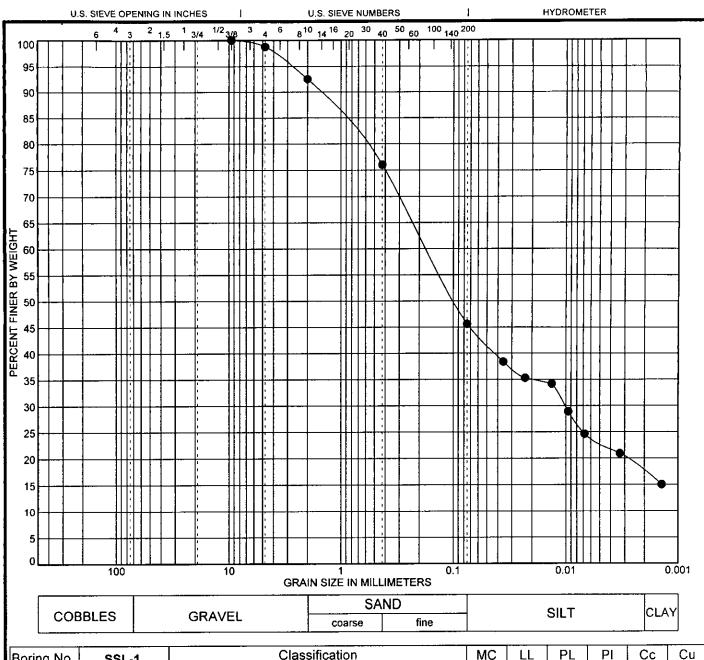
Fax: 317-585-8621 e-mail: ctlin@ctleng.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



Boring No.	SSL-1			Classification	MC	LL PL	PI	Сс	Cu		
Sample	SS-3		s	SANDY LOA		11	22 12	10			
Depth	1.83-2.29			A-4(1)							
Station	10+293			Lab 2							ļ
Offset	15 m Lt										
Line	"B"										
Remarks		D100	D60	D50	D30	D10	%Grave	%Sand	%Silf	9	6Clay
		9.5	0.17	0.096	0.01		7.5	46.9	28.1		17.5
							1				



CTL Engineering of Indiana, Inc. 6848 Hillsdale Court Indianapolis, Indiana 46250 Phone: 317-585-8277

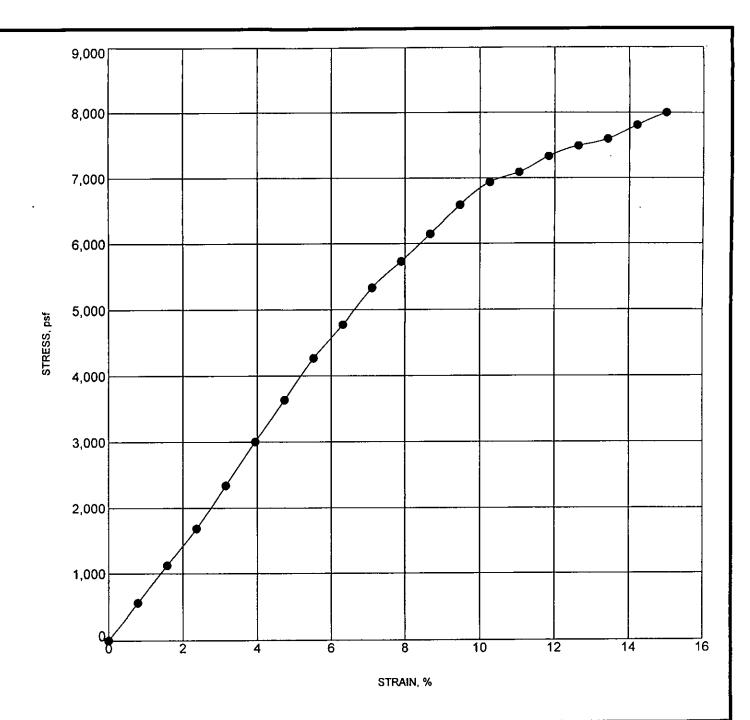
Fax: 317-585-8621 e-mail: ctlin@ctleng.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061



Boring Inforn	nation	Test Results	English	Metric	
Boring No.	SSL-1	Natural Moisture Content, %	11	11	
Sample	SS-4	Natural Wet Density, pcf (kg/m³)	139.4	(2235)	
Depth	2.59 - 3.05	Natural Dry Density, pcf (kg/m³)	125.3	(2008)	
Station	10+293	Unconfined Compression Strength, psf (kN/m²)	8003	(383)	
Offset	15 m Lt	Failure Strain, %	15.0	15.0	
Line	"B"	SOIL DESCRIPTION			



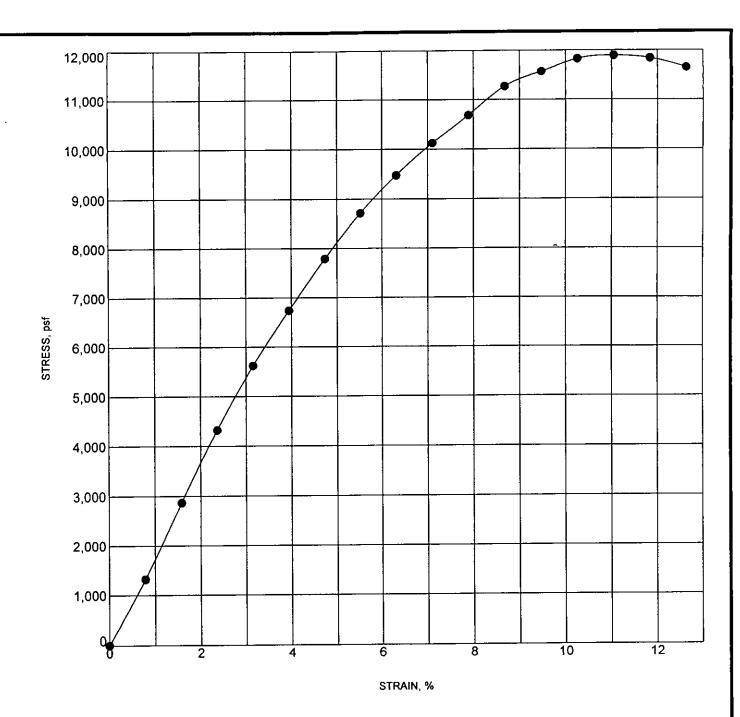
CTL Engineering of Indiana, Inc. 6848 Hillsdale Court Indianapolis, Indiana 46250

Phone: 317-585-8277 Fax: 317-585-8621

UNCONFINED COMPRESSION TEST

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.



Boring Inform	nation	Test Results	English	Metric
Boring No.	SSL-2	Natural Moisture Content, %	11	11
Sample	SS-2	Natural Wet Density, pcf (kg/m³)	132.3	(2120)
Depth	1.07 - 1.53	Natural Dry Density, pcf (kg/m³)	118.8	(1904)
Station	10+473	Unconfined Compression Strength, psf (kN/m²)	11893	(569)
Offset	15 m Lt	Failure Strain, %	11.1	11.1
Line	"B"	SOIL DESCRIPTION		



CTL Engineering of Indiana, Inc. 6848 Hillsdale Court Indianapolis, Indiana 46250

Phone: 317-585-8277 Fax: 317-585-8621

e-mail: ctlin@ctleng.com

UNCONFINED COMPRESSION TEST

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co.

Des. No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

Sheet 1 of 1

Boring No.	Station	Offset	Line	Sample No.	Depth (m)	Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Unconfined Compression (psf)	Failure Strain (%)	Loss on Ignition (%)	ρН
SSL-1	10+293	15 m Lt	"B"	SS-1	0.30-0.76	13					,	8.34
SSL-1	10+293	15 m Lt	"B"	SS-3	1.83-2.29	11						8.39
SSL-1	10+293	15 m Lt	"B"	SS-4	2.59-3.05	11	139.4	125.3	8003	15.0		
SSL-1	10+293	15 m Lt	"B"	SS-5	4.11-4.57	12						
SSL-1	10+293	15 m Lt	"B"	SS-6	5.03-5.49	22						-
SSL-2	10+473	15 m Lt	"B"	SS-1	0.30-0.76	11						
SSL-2	10+473	15 m Lt	"B"	SS-2	1.07-1.52	11	132.3	118.8	11893	11.1		·
SSL-2	10+473	15 m Lt	"B"	SS-4	2.59-3.05	12						
SSL-2	10+473	15 m Lt	"B"	SS-6	5.64-6.10	19						
SSL-2	10+473	15 m Lt	"B"	SS-8	8.69-9.14	12.						
SSL-3	10+600	20 m Lt	"8"	SS-2	1.07-1.52	20						
SSL-3	10+600	20 m Lt	"B"	SS-3	1.83-2.29	7.						
TB-2	10+126.5	20m Lt	"C"	SS-1B	0.30-0.61	21						



CTL Engineering of Indiana, Inc. 6848 Hillsdale Court Indianapolis, Indiana 46250 Phone: (317) 585-8277 Fax: (317) 585-8621

e-mail: ctlin@ctleng.com

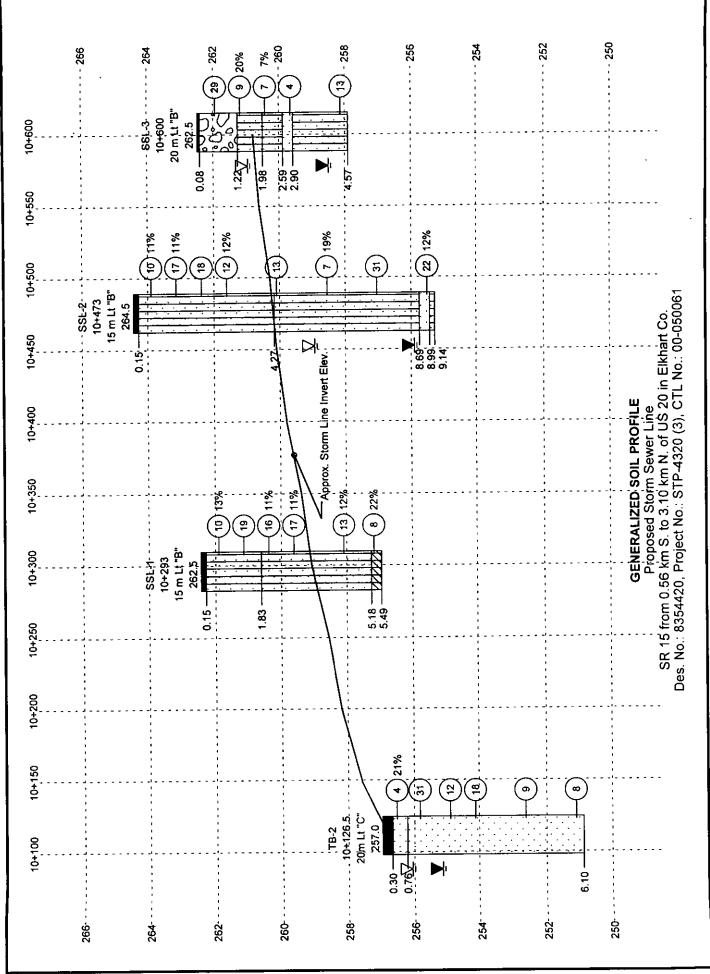
SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project: Proposed Storm Sewer Line

Location: SR 15 from 0.56 km S. to 3.10 km N. of US 20 in Elkhart Co. Project No.: 8354420, Project No.: STP-4320 (3), CTL No.: 00-050061

APPENDIX D GENERALIZED SOIL PROFILE







Indiana Department of Transportation

Materials and Tests Division

120 South Shortridge Road P.O. Box 19389 Indianapolis, Indiana 46219-0389 Phone: (317) 610-7251 Fax: (317) 356-9351

March 30, 2004

CTL Engineering, Inc. 6330 E. 75th St. Suite 178 Indianapolis, Indiana 46250

Attn:

Mr. Ali Karaki

Subject:

Des No:

8354420

Project No:

STP - 4320 (3)

N/A

Structure No:

SR 15, S. of US 20 to US 20 to 3.1 km N. of US 20

County:

Elkhart

District:

Fort Wayne

Gentlemen:

In accordance with the agreement dated November 8, 2001 the Final Quantities and Costs for the Geotechnical Investigation on the subject project have been calculated. Transmitted herewith is one copy of the following:

- Itemization of Pay Quantities for Geotechnical Borings, and Tests. 1.
- 2. Report of Final Costs for the Geotechnical Investigation.
- Performance Evaluation of Consultant's Highway Development Services. 3.

The total cost for the Geotechnical Work performed on the subject project is \$3,459.00 Therefore, in order to finalize the payment, please submit an invoice voucher for \$3,459.00 to:

> Mr. Athar Khan, P.E. Chief Geotechnical Engineer INDOT Division of Materials and Tests 120 South Shortridge Road P.O. Box 19389 Indianapolis, IN 46219-0389

If you have any questions concerning this matter, please call us.

Athar Khan

Chief Geotechnical Engineer

Somanath Hiremath

Geotechnical Engineering Group Leader

SSH/SS

cc:

Mr. R. Asadi

File (Attachments) H:bigal/OEA-356-357-evaluation

ITEMIZATION OF PAY QUANTITIES FOR INDOT SOIL BORINGS, REPORTS & PROFILES (TD-356)

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IRE NO Khart DATE:	\parallel		╟	\vdash	\vdash	-
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SHEET: 1 OF NA STRUCTURE NO: N/A COUNTY: Elkhart DATE: 3/0	_		-	_		-
SHEET: STRI OUNTY:	\vdash		-	-		-
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\$ 20	<u></u>		-		H	
PS	3 61	pH	2			1
1NDOT 4320 (7 m N. of BY:	2 53	a. Unconfined Compression	_	_	\vdash	2
60 A K	1 52	Hydrometer.	2 2		Н	2 2
FOR: INI NO: STP - 43 S 20 to 3.1 km N CHECKED BY	50 51	Sieve Analysis Plastic Limit	2 2			2
US 2	49 5	Liquid Limit	7			2
PROJECT NO: STP - 4320 (7) 8 15 8.0f US 20 to 3.1 km N. of UTilahun CHECKED BY:	48 4	Moisture Content	4	4	2	10
FOR: INDOT PROJECT NO: STP - 4320 (7) 1.SR 15 S.of US 20 to 3.1 km N. of US 20 ew Tilahun CHECKED BY:	╟─		-	_	Н	
	42	b. 10 to 30 feet	-	-		2
BY: CTL Engineering, Inc. DES: 8354420 LOCATION: Road Rehabilitation of	41	b. 24-hr measurements-PVC Slotted Pipe	18	30		48
ring, thabi	•	a. Field Measurements		ļ	1	3
CTL Engineering, Inc. 54420 ON: Road Rehabilitati	39	Resident Engineer				8
17 E	56	a. Setup for borings < 20'	-		-	2
BY: CTL EDES; 8354420 LOCATION: FREPARED B	9	a. Through Boulders				
BY: DES LOC	က	Truck Borings	18.0	30.0	15.0	63.0
		- L. Field O disadisa	-	_		
		c. Field Coordination				
	1	c. Field Coordination b. Mileage				300
		a. Equipment				-
		Boring No.	SSL-1	SSL-2	SSL-3	Total
	<u>L</u>		IL		<u></u> _	<u> L</u>

INDIANA DEPARTMENT OF TRANSPORTATION DIVISION OF MATERIALS AND TESTS

Geotechnical Section

REPORT OF FINAL COSTS FOR GEOTECHNICAL AND PAVEMENT
INVESTIGATIONS BETWEEN INDOT AND CTL
ENGINEERING, INC. DATED AND TO AND CORDANCE
WITH STATE WIDE GEOTECHNICAL INVESTIGATION

DES NO: 8354420 PROJECT NO: STP - 4320(7) STRUCTURE NO: N/A LOCATION: SR 15,

			garinian la la la la la la la la la la la la la	and the second s	to the first of the second second second second second second second second second second second second second
ITEM	ITEM DESCRIPTION	UNIT	UNIT	FINAL	FINAL
NO.	A GEOTECHNICAL ELEI D IMPERTICATION		PRICE	QUANTITY	COST
(1)	A. GEOTECHNICAL FIELD INVESTIGATION				
(1)	Mobilization	Each	\$190.00	1.00	\$190.00
	a. Equipment	·	\$2.00	300.00	\$600.00
	b. Mileage	per mile	\$220.00	1.00	\$220.00
(2)	c. Field Coordination wth Utilities and Property owners	Each LF	i	0.00	\$0.00
(2)	Truck Mounted Borings with 2 feet Auger Head	LF LF	\$9.00	1	\$888.30
(3)	Truck Mounted Borings with Split-Spoon Sampling	$-\frac{LF}{LF}$	\$14.10	63.00	\$0.00
(4)	Truck Mounted Borings using Drilling Fluid	-	\$13.90	0.00	1
(5)	Truck Mounted Core Drilling	LF	\$28.00	0.00	\$0.00
(6)	Truck Mounted Borings			2.00	20.00
	a. Through Bedrock or Boulders	$_ig ^{LF}$	\$24.20	0.00	\$0.00
	b. Bridge Deck Coring and Restoration	Each	\$200.00	0.00	\$0.00
('7)	Cone Penetrometre	LF .	\$12.00	0.00	\$0.00
(8)	Hand or Truck Soundings	$_{\perp} _{LF}$	\$8.90	0.00	\$0.00
(9)	Hand Auger Drilling	$_$ LF	\$9.90	0.00	\$0.00
(10)	Skid Mounted Borings with 2 feet Auger Head	LF	\$13.40	0.00	\$0.00
(11)	Skid Mounted Borings with Split-Spoon Sampling	LF	\$21.00	0.00	\$0.00
(12)	Skid Mounted Borings using Drilling Fluid	LF	\$21.90	0.00	\$0.00
(13)	Skid Mounted Core Drilling	LF	\$33.00	0.00	\$0.00
(14)	Skid Mounted Borings through Bedrock or Boulders	LF	\$32.75	0.00	\$0.00
(15)	Skid Mounted Sounding	LF	\$12.50	0.00	\$0.00
(16)	Furnishing of Boat for Hand Auger Soundings	Each	\$240.00	0.00	\$0.00
(17)	Barge Set-Up Expenses				İ
	a. Navigable Water				
	i. Barge Set-Up	Each	\$3,850.00	0.00	\$0.00
	ii. Rental of Support Equipment	Cost + 10%	\$0.00	0.00	\$0.00
	iii. Drill Rig Down Time	Per Hour	\$99.00	0.00	\$0.00
	b. Non-Navigable Water Barge Set-Up	Each	\$3,400.00	0.00	\$0.00
(18)	Additional Disassembly and Reassemble				
(>	a. Navigable Water	Each	\$1,540.00	0.00	\$0.00
	b. Non-Navigable Water	Each	\$1,350.00	0.00	\$0.00
(19)	Barge Mounted Borings with 2 feet Auger Head	LF	\$14.90	0.00	\$0.00
(20)	Barge Mounted Borings with Split-Spoon Sampling	$ _{LF}$	\$23.00	0.00	\$0.00
(21)	Barge Mounted Core Drilling	$_{LF}$	\$35.00	0.00	\$0.00
(22)	Barge Mounted Boring through Bedrocks or Boulders	$_{LF}$	\$38.00	0.00	\$0.00
(23)	Barge Mounted Soundings	$_{LF}^{-}$	\$14.40	0.00	\$0.00
(24)	Casing through Water	$-\frac{1}{LF}$	\$6.50	0.00	\$0.00
(25)	Uncased Sounding through Water	$- _{LF}^{\Box}$	\$3.50	0.00	\$0.00
(26)	Set-up for Boring and Machine Sounding	_			
11 ~ 177	a. All Borings and Machine sounding Less Than 20 feet deep.	Each	\$53.00	2.00	\$106.00
	b. Roch Core Borings.	Each	\$90.00	0.00	\$0.00
(27)	Additional 2-inch Split-Spoon Samples	Each	\$15.00	0.00	\$0.00
(28)	3 inch Split-Spoon Samples	Each	\$16.50	0.00	\$0.00
(29)	3-inch Shelby Tube Samples	Each	\$50.00	0.00	\$0.00

ITEM	ITEM DESCRIPTION	UNIT	UNIT	FINAL	FINAL
NO	TI LIVE I LANGE TE LEGIN	CIVIT	PRICE	DUANTITY	COST
(30)	2 -inch Shelby Tube Samples	Each	\$44.50	0.00	\$0.00
(31)	3-inch Stationary Piston Samples	Each	\$81.00	0.00	\$0.00
(32)	Bag Samples	Luca	307.00	0.00	\$0.00 1
(32)	a. 300 Ib Sample	Each	\$84.00	0.00	\$0.00
1	b. 25 lb Sample	Each	\$30.00	0.00	\$0.00
(33)	Field Vane Shear Test	Each	\$86.00	0.00	\$0.00
(34)	Denison Type Core Sample	Each	\$121.00	0.00	\$0.00
(35)	2 1/2 inch Cased Hole	LF	\$6.30	0.00	\$0.00
(36)	3 1/2 inch Cased Hole	LF	\$7.50	0.00	\$0.00
(37)	4 1/2 inch Cased Hole	LF	\$9.40	0.00	\$0.00
(38)	Special Field Services	121	\$7.70	0.00	\$0.00
(30)	a. Inclinometer Casing Installation.	LF	\$17.00	0.00	\$0.00
	b. Piezometer Installation Up to 26 feet Below Surface.	Each	\$223.00	0.00	\$0.00
	c. Piezometer Installation Deeper than 26 feet	Each	\$310.00	0.00	\$0.00
	d. Metal Protective Outer Cover for Inclinometer and Piez. Casing	Each	\$108.00	0.00	\$0.00
	e. Special Field Services	Per hour	\$113.00	0.00	\$0.00
7301	Resident Field Geotechnical Engineer	rer nour	\$275.00	0.00	30.00
(39)	(See Section II - D of this Appendix)	Per Hour	\$78.00	8.00	\$624.00
(40)		Cost + 10%	\$0.00	0.00	\$0.00
(40) (41)	Railroad Expenses Twenty Four Hour Water Levels	Cost + 10%	30.00	0.00	30.00
(41)	a. Field Measurements	Each	\$27.50	3.00	\$82.50
	b. PVC Slotted Pipe	LF	\$4.40	48.00	\$211.20
(42)	Special Backfilling of Boreholes	Lr	34.40	40.00	\$211.20
(4-2)		Each	\$82.00	2.00	\$164.00
	a. 10 to 30 feetb. More than 30 feet	LF	\$5.00	0.00	\$0.00
		Each	\$40.00	0.00	\$0.00
(43)	c. Pavement Restoration Heavy Equipment Rental_(Dozer)	Cost + 10%	\$0.00	0.00	\$0.00 \$0.00
(44)	Skid Rig Moving Time in Excess of 1/2 Hour	Per Hour			
(44) (45)	Traffic Control	Per Hour	\$113.00	0.00	\$0.00
(43)			\$150.00	0.00	50.00
	a. Worksite Setup 1 or 6	per day per day	\$130.00 \$520.00	0.00	\$0.00 \$0.00
	b. Worksite Setup 4	ľ ·	\$470.00	0.00	\$0.00 \$0.00
	c. Worksite Setup 9	per day	\$515.00	0.00	\$0.00
	d. Worksite Setup 11e. Worksite Setup 7	per day		0.00	· ·
(46)	•	per day	\$1,000.00	0.00	\$0.00
(40)	Centerline Surveying SUBTOTALS	Cost + 10%	\$0.00	1 0.00	\$0.00
ГТЕМ	ITEM DESCRIPTION	TOUTT	i nim	FINAY	\$3,086.00
	TIEM:DESCRIPTION	UNIT	UNIT		FINAL
NO	D. CROTECHNICAL LABORATORY TECTING		PRICE	QUANTITY	COST
(4 7)	B. GEOTECHNICAL LABORATORY TESTING		5270.00	0.00	60.00
(47)	Hydraulic Conductivity Test	Each Each	\$270.00	0.00	\$0.00
(48)	Moisture Content Test	1	\$5.20	10.00	\$52.00
(49)	Liquid Limit	Each	\$25.30	2.00	\$50.60
(50)	Plastic Limit and Plasticity Index	Each	\$17.50	2.00	\$35.00
<i>(51)</i>	Sieve Analysis	Each	\$35.20	2.00	\$70.40
(52)	Hydrometer Analysis	Each	\$38.50	2.00	\$77.00
(53)	a. Unconfined Compression Test	Each	\$33.00	2.00	\$66.00
	b. Remolding of three (3) Soil Samples with lime/cement	Engli	597.00	0.00	\$0.00
151	(3 samples = one unit)	Each	\$86.00	0.00	\$0.00
(54)	Specific Gravity Test	Each	\$28.50	0.00	\$0.00
(55)	Unit Weight Determination	Each	\$13.70	0.00	\$0.00
(56)	Consolidation Test	Each	\$360.00	0.00	\$0.00
(57)	a Unconsolidated-Undrained (UU)	Each	\$270.00	0.00	\$0.00
	b Consolidated-Undrained (CU)	Each	\$420.00	0.00	\$0.00
	c. Consolidated-Drained (CD)	Each	\$590.00	0.00	\$0.00
	d. Pore Pressure Measurement with a. or b.	1	1		

	and Use of Back Pressure for Saturation	Each	\$200.00	0.00	\$0.00
(58)	Soil Support Test	İ			
ĺ	a. California Bearing Ratio Test	Each	\$4 10.00	0.00	\$0.00
	b. Subgrade Resilient Modulus	Each	\$ 800.00	0.00	\$0.00
(59)	Standard Moisture-Density Relationship Test	Each	\$107.00	0.00	\$0.00
60)	Loss on Ignition Test	Each	\$16.50	0.00	\$0.00
(61)	pH Test	Each	\$11.00	2.00	\$22.00
	SUBTOTALS				\$373.00
0.000				leept (/	FINAL
<i>ITEM</i>	ITEM DESCRIPTION	UNIT	UNIT	FINAL	COST
NO.			PRICE	DUANTITY	CONT
	O CROTECHNICAL ENGINEERING				
	C. GEOTECHNICAL ENGINEERING				
(62)	Geotechnical Profile and Related Work	Lump Sum	\$950.00	0.00	\$0.00
	a. Without Soil Subgrade DrawingsFirst Mile	per mile	\$425.00	0.00	\$0.00
	al-Each Additional Mile	! *	\$1,150.00	0.00	\$0.00
	b. With Soil Subgrade Drawings First Mile b1 - Each Additional Mile	Lump Sum per mile	\$500.00	0.00	\$0.00
		Lump Sum	\$275.00	0.00	\$0.00
	c. Soil Subgrade Drawings (only) First Mile	per mile	175.00	0.00	\$0.00
· • • •	c1 - Each Additional Mile	per mite	175.00	0.00	20.00
(63)	Geotechnical Report	Lump Sum	\$1,140.00	0.00	\$0.00
	a. Without Soil Subgrade Investigation First Mile_	per mile	\$500.00	\$0.00	\$0.00
	a1 - Each Additional Mile	Lump Sum	\$1,500.00	0.00	\$0.00
	b. With Soil Subgrade Investigation First Mile	per mile	\$600.00	\$0.00	\$0.00
	b1 - Each Additional Mile	Lump Sum	\$480.00	0.00	\$0.00
	c. Soil Subgrade Investigation (only) First Mile	per mile	\$275.00	\$0.00	\$0.00
	c1 - Each Additional Mile	per mue	\$275.00	30.00	
(64)	Settlement Analysis and Recommendations for Embankment	Each	\$660.00	0.00	\$0.00
	a. Proposed Embankment	— Each	\$700.00	0.00	\$0.00
1561	b. Proposed and Existing Embankment	Each	\$1,100.00	0.00	\$0.00
(65)	Ground Modification Design	Bach	\$1,100.00	0.00	
(66)	Sliding Block Slope Stability Analysis a. C/O or C and O Analysis	Each	\$495.00	0.00	\$0.00
	b. Corrective Measures	Each	\$715.00	0.00	\$0.00
	c. Stage Construction Corrective Method	Each	\$935.00	0.00	\$0.00
44 3 1	- -		0,00,00	1	
(67)	Rotational Slope Stability Analysis	Each	\$550.00	0.00	\$0.00
	a. C/O or C and O Analysis b. Corrective Measures	Each Each	\$670.00	0.00	\$0.00
	b. Corrective Measures c. Stage Construction Corrective Method	Each	\$900.00	0.00	\$0.00
// UI	Bridge Foundation Analysis and Recommendations				
(68)	a. Shallow Foundation	Each	\$380.00	0.00	\$0.00
	b. Deep Foundation	Each	\$675,00	0.00	\$0.00
	c. Settlement Analysis for Bridge Pier Foundations	_			
		Each	\$385.00	0.00	\$0.00
	1. Bridge Pier	Each	\$655.00	0.00	\$0.00
	3. Embankment Plus Pier Plus All Other Loads	Each	\$825.00	0.00	\$0.00
	d. Foundation on Rock	Each	\$220.00	0.00	\$0.00
(69)	Retaining Structure Analysis and Recommendations				
[02]	a. Conventional Retaining Structure and other types (MSE & Bit	ı nwalls)	1		
	Conventional Relating Structure and other types (WSL & But Shallow Foundation	1	\$650.00	0.00	\$0.00
	2. Deep Foundation	Each	\$825.00	0.00	\$0.00
	Settlement Analysis for Retaining Wall Foundations	Each	\$480.00	0.00	\$0.00
	b. Pile Retaining Structure Analysis and Recommendations			1	1
1	1. Free Standing Structure Analysis and Recommendations 1. Free Standing Structure	Each	\$660.00	0.00	\$0.00

	2. Retaining Structure with Tie-Back System	Each	\$1,100.00	0.00	\$0.00 *
	c. Drilled-in-Pier Retaining Structure Analysis	Luch	01,100.00		
	1. Free Standing Structure	Each	\$770.00	0.00	\$0.00
	2. Retaining Structure with Tie-Back System	Each	\$1,130.00	0.00	\$0.00
	• -	Each	\$810.00	0.00	\$0.00
701	d. Soil Nailing Wall Analysis	Each	\$700.00	0.00	\$0.00
70)	Scepage Analysis	Each	\$990.00	0.00	\$0.00
71)	Deep Dynamic Compaction Analysis	Eucn	\$770.00	0.00]
	CONSTRUCTION INSPECTION AND MONITORING	Per hour	\$52,50	0.00	\$0.00
72)	Field Inspector	1	\$52.50 \$52.50	0.00	\$0.00
73)	Monitoring Geotechnical Instrumentation	Per hour		0.00	\$0.00
74)	Integrity Test	Cost + 10%	\$0.00		\$0.00
75)	Dynamic Pile Analysis	Each	\$770.00	0.00	\$0.00
76)	Static Load Test	Each	\$760.00	0.00	·
77)	Dynamic Pile Load Test	Each	\$0.00	0.00	\$0.00
78)	CAPWAP-C Analysis	Each	\$600.00	\$0.00	\$0.00
79)	Final Construction Inspection Report	Each	\$800.00	0.00	\$0.00
	SUBTOTALS	J			\$0.00
ГЕМ	ITEM DESCRIPTION	UNIT	UNIT	FINAL	FINAL
NO			PRICE	DUANTITY	COST
	D. PAVEMENT INVESTIGATION	Each	\$85.00	0.00	\$0.00
)	Mobilization of Coring Equipment	-	\$1.40	0.00	\$0.00
?)	Mobilization Mileage for Coring Equipment	per mile Each	\$1.40	0.00	\$0.00
3)	Pavement Core (Partial Depth)	-			\$0.00
4)	Pavement Core (Full Depth)	Each	\$150.00	0.00	1
5)	Subbase Sample	Each	\$47.00	0.00	\$0.00 \$0.00
6)	Cement Concrete Pavement Core Density Determination	Each	\$25.00	0.00	\$0.00
7)	Cement Concrete Core Compressive Strength Test	Each	\$29.00	0.00	\$0.00
8)	Bituminous Extraction Test	Each	\$66.00	0.00	
9)	Sieve Analysis of Extracted Aggregate Test	Each	\$44.00	0.00	\$0.00
10)	Recovery of Asphalt from Solution by Abson Method	Each	\$340.00	0.00	\$0.00
71)	Theoretical Maximum Specific Gravity Test	Each	\$65.00	0.00	\$0.00
(12)	Bulk Specific Gravity Test	Each	\$28.00	0.00	\$0.00
73)	Air Voids Calculation	Each	\$22.00	0.00	\$0.00
(14)	Core Report for Partial Depth Core	Each	\$26.00	0.00	\$0.00
(15)	Core Report for Full Depth Core	Each	\$35.00	0.00	\$0.00
16)	Pavement Analysis and Report	Each	\$640.00	0.00	\$0.00
	SUBTOTALS		L		\$0.00
	TOTALS				\$3,459.00
					<u> </u>
7)	FINAL COST OF GEOTECHNICAL FIELD INVESTIGATION	' (A)			\$3,086.00
2)	FINAL COST OF GEOTECHNICAL LABORATORY TESTING	G (B)			\$373.00
3)	FINAL COST OF GEOTECHNICAL ENGINEERING (C)		<u>.</u> .		\$0.00
4)	FINAL COST OF GEOTECHNICAL INVESTIGATION				\$3,459.00
(5)	FINAL COST OF PAVEMENT INVESTIGATION (D)				\$0.00
(6)	TOTAL FINAL COST OF GEOTECHNICAL AND PAVEMENT	T INVESTIGATIO	ON		\$3,459.00
	PREPARED BY: A.T				
	CHECKED BY: S.S				
		7			
	DATED: 3/09/2004				

ITEMIZATION OF PAY QUANTITIES FOR INDOT SOIL BORINGS, REPORTS & PROFILES (TD-356)

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NE NO: N/A khart DATE: 3/05/04				_		
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SHEET: STRU COUNTY:						_
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Shahid Siddiqui						
US.	61	рН	2	_		72
1NDOT 4320 (7 m N. of BY:	23	a. Unconfined Compression	1	-	 	2
FOR: INDC NO: STP - 4320 S 20 to 3.1 km N. CHECKED BY:	52	Hydrometer.	2			2
STP CKE	51	Sieve Analysis	2			7
FOR: S 20 to CHECK	20	Plastic Limit	2			7
CTN	49	Liquid Limit	2			2
FOR: INDOT PROJECT NO: STP - 4320 (7) 8 15 S.of US 20 to 3.1 km N. of U	48	Moisture Content	4	4	2	5
on SF	42	b. 10 to 30 feet	1	1		2
BY: CTL Engineering, Inc. DES: 8354420 LOCATION: Road Rehabilitation PREPARED BY: Aleba	41	b. 24-hr measurements-PVC Slotted Pipe	18	30		48
ehab		a. Field Measurements	1	1	-	3
CTL Engineering, Inc. 54420 ON: Road Rehabilitati	39	Resident Engineer	L			8
2TL E	26	a. Setup for borings < 20'	1		-	2
BY: CTL End DES: 8354420 LOCATION: Roll PREPARED BY:	9	a. Through Boulders				
BY: DES LOC PRE	3	Truck Borings	18.0	30.0	15.0	63.0
		c. Field Coordination				~
	-	b. Mileage				300
		a. Equipment				٢
		Boring No.	SSL-1	SSL-2	SSL-3	Total



Indiana Department of Transportation

Materials and Tests Division

120 South Shortridge Road P.O. Box 19389 Indianapolis, Indiana 46219-0389 Phone: (317) 232-5280 Fax: (317) 356-9351 September 4, 2001

CTL Engineering, Inc. 6330 E. 75th St. Suite 178 Indianapolis, Indiana 46250

Attn:

Mr. Ali Karaki

Subject:

Des No:

8354420

Project No:

STP-4320 (7)

SR 15 from 0.56 km S. of US 20 to a point 3.10 km N. of US 20

County:

Elkhart

District:

Fort Wayne

Gentlemen:

In accordance with the agreement dated August 18, 1999, the Final Quantities and Costs for the Geotechnical Investigation on the subject project have been calculated. Transmitted herewith is one copy of the following:

- Itemization of Pay Quantities for Geotechnical Borings, and Tests. 1.
- 2. Report of Final Costs for the Geotechnical Investigation.
- Performance Evaluation of Consultant's Highway Development Services. 3.

28511.75

The total cost for the Geotechnical Work performed on the subject project is \$27,911.75 Therefore, in order to finalize the payment, please submit an invoice voucher for \$27,911.75 to:

Mr. Athar Khan, P.E.

Chief Geotechnical Engineer

INDOT Division of Materials and Tests

120 South Shortridge Road

P.O. Box 19389

Indianapolis, IN 46219-0389

If you have any questions concerning this matter, please call us.

28511.75

Chief Geotechnical Engineer

For Somanath Hiremath

Geotechnical Engineering Group Leader

SSH/SS

Mr. R. Asadi

File (Attachments)

H:JOEY/OEA-356-357-evaluation

ITEMIZATION OF PAY QUANITIES FOR INDOT SOIL BORINGS, REPORTS & PROFILES (TD-356)

OF 2			,
SHEET	UCTURE NO: N/A	rY: EIKhart	ATE: 8/28/2001
	STRUC	J. of US 20 COUNTY:	<u>sieldiqui</u> D
DOT	CT NO: STP-4320 (1)	tea point 3.10 Km N	TECKED BY: SARANd
FOR: IND	PROJECT NO.	S. of US 20 to a	UV CHEC
ngineeFing, Inc	1420 1	Tram 0.56 Km	ebachew Tilah
BY: CTL- Engi	DES NO: 635	LOCATION: SRIS	PREPARED BY: AL

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ITEMIZATION OF PAY QUANTIES FOR INDOT SOIL BORINGS, REPORTS & PROFILES (TD-356)

SHEET 1 OF 2	STRUCTURE NO: N/A	FUS 20 COUNTY: EIRHAFT	S. 24:001 DATE: \$ 128/2001
FOR: 1NDOT	PROJECT NO: STP- 4320(7)	· S of US 20 to a Point 3.10km of	CHECKED BY: Sha hid
BY: CTL Engineering, Inc	DES NO: 835 4420	LOCATION: SR IS from 0.56 KM	PREPARED BY: Ale bachew Trlahon

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3	Truck	SS	Boring	7.32	9.76	12.19	6.71	7.26	2.69	1.93	1.88	1.99	1.91	2.29	2.29	1.88	2.87	7.52	2.16	7.01	4.57	6.10	4.57	94.90	227.43
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	Boring	ė Š		RB-24	RB-25	RB-26	RB-27	RB-28	RB-29	RB-30	RB-31	RB-32	RB-33	RB-34	RB-35	RB-36	RB-37	RB-38	RB-39	RB-40	TB-1	TB-2	TB-3	Sub-Total	TOTAL

See Attached



R.J. BONTFIAGER EXCAVATING 15256 C.R. 28 GOSHEN, IN 46528

DATE - // - O/

(219) 825-7271

CTL Engineering of Indy 6330 E. 75th Stoot, Suite 176 Indiagapelis, In. 46250

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R.J. BONTRAGER EXCAVATING

Thank You PAY LAST AMOUNT IN THIS COLUMN

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INDIANA DEPARTMENT OF TRANSPORTATION DIVISION OF MATERIALS AND TESTS

Geotechnical Section

REPORT OF FINAL COSTS FOR GEO. AND PAVEMENT INVESTIGATIONS BETWEEN INDOT AND C. T. L. Inc. DATED Aug. 13, 1999 IN ACCORDANCE WITH STATE WIDE GEOTECHNICAL INVESTIGATION

DES NO: 8354420

PROJ NO: STP-4320(7)

STRUC NO: N/A

LOCATION: SR 15 from 0.56 Km S.of US 20

COUNTY: Elkhart

			COUNTY	Liknari	Later the second of the second
ITEM NO	ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL QUANTITY	FINAL COST
	A. GEO. FIELD INVESTIGATION		<u> </u>	<u> </u>	
<i>(1)</i>	Mobilization and Field Coordination	1			
1-2	a Equipment	Each	\$180.00	1.00	\$180.00
	b Mileage	per kilometer	\$1.20	550.00	\$660.00
	c Field Coordination with Utilities and property Owners	Each	\$200.00	2.00	\$400.00
(2)	Truck Mounted Borings with .6 Meter Auger Head	Meter	\$28.00	0.00	\$0.00
(3)	Truck Mounted Borings with Split-Spoon Sampling	Meter	\$42.00	227.43	\$9,552.06
(4)	Truck Mounted Borings using Drilling Fluid	Meter	\$42.00	0.00	\$0.00
(5)	Truck Mounted Core Drilling	Meter	\$85.00	0.00	\$0.00
(6)	Truck Mounted Borings			0.00	
1 -2	a. Through Bedrock or Boulders	Meter	\$72.00	7.03	\$506.16
	b. Bridge Deck Coring and Restoration	Each	\$200.00	0.00	\$0.00
(7)	Hand or Truck Soundings	Meter	\$26.50	3.55	\$94.08
(8)	Hand Auger Drilling	Meter	\$29.50	0.00	\$0.00
(9)	Skid Mounted Borings with .61 or Meter Auger Head	Meter	\$41.50	0.00	\$0.00
(10)	Skid Mounted Borings with Split-Spoon Sampling	Meter	\$65.20	0.00	\$0.00
(11)	Skid Mounted Borings using Drilling Fluid	Meter	\$64.00	0.00	\$0.00
(12)	Skid Mounted Core Drilling	Meter	\$98.50	0.00	\$0.00
(13)	Skid Mounted Borings through Bedrock or Boulders	Meter	\$98.50	0.00	\$0.00
(14)	Skid Mounted Sounding	Meter	\$39.50	0.00	\$0.00
(15)	Furnishing of Boat for Hand Auger Soundings	Each	\$220.00	0.00	\$0.00
(16)	Barge Set-Up Expenses		Ì]
,	a. Navigable Water		1		
	1. Barge Set-Up	Each	\$3,500.00	0.00	\$0.00
	2. Rental of Support Equipment	Cost + 10%	\$0.00	0.00	\$0.00
	3. Drill Rig Down Time	Per Hour	\$95.00	0.00	\$0.00
	b. Non-Navigable Water Barge Set-Up	Each	\$3,000.00	0.00	\$0.00
(17)	Additional Disassembly and Reassemble				}
, ,	a. Navigable Water	Each	\$1,480.00	0.00	\$0.00
	b. Non-Navigable Water	Each	\$1,290.00	0.00	\$0.00
(18)	Barge Mounted Borings with .6 Meter Auger Head	Meter	\$46.20	0.00	\$0.00
(19)	Barge Mounted Borings with Split-Spoon Sampling	Meter	\$68.75	0.00	\$0.00
(20)	Barge Mounted Core Drilling	Meter	\$112.00	0.00	\$0.00
(21)	Barge Mounted Boring through Bedrocks or Boulders	Meter	\$123.00	0.00	\$0.00
(22)	Barge Mounted Soundings	Meter	\$45.00	0.00	\$0.00
(23)	Casing through Water	Meter	\$19.50	0.00	\$0.00
(24)	Uncased Sounding through Water	Meter	\$11.50	0.00	\$0.00
(25)	Set-up for Borings and Machine Soundings	1			
	a All Borings and Machine Soundings Less than 6m Deep	Each	\$50.00	29.00	\$1,450.00
	b Rock Core Borings	Each	\$82.00	0.00	\$0.00
(26)	Additional 51 millimeter Split-Spoon Samples	Each	\$14.00	0.00	\$0.00
(27)	76 millimeter Split-Spoon Samples	Each	\$15.00	0.00	\$0.00
(28)	76 millimeter Shelby Tube Samples	Each	\$50.00	0.00	\$0.00

ITEM	ITEM DESCRIPTION	UNIT	UNIT	FINAL	FINAL
NO.	THEM BESCRIFTIUN	UIVII.	PRICE	TINAL DUANTITY	COST
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(29)	51 millimeter Shelby Tube Samples	Each	\$44.50	0.00	\$0.00
(30)	76 millimeter Stationary Piston Samples	Each	\$80.00	0.00	\$0.00
(31)	Bag Samples		1		}
	a. 136 Kg Sample	Each	\$75.00	1.00	\$ 75.00
	b. 11 Kg Sample	Each	\$27.50	0.00	\$0.00
(32)	Field Vane Shear Test	Each	\$86.00	0.00	\$0.00
(33)	Denison Type Core Sample	Each	\$110.00	0.00	\$0.00
(34)	63 millimeter Cased Hole	Meter	\$20.00	0.00	\$0.00
(35)	89 millimeter Cased Hole	Meter	\$23.00	0.00	\$0.00
(36)	114 millimeter Cased Hole	Meter	\$28.00	0.00	\$0.00
(37)	Special Field Services				!
	a. Inclinometer Casing Installation	Meter	\$80.00	0.00	\$0.00
	b. Piezometer Installation up to 8 m below the surface	Each	\$330.00	0.00	\$0.00
	c. Piezometer Installation Deeper than 8 m below the surface	Each	\$350.00	0.00	\$0.00
	d. Metal Protective Outer Cover For Inclinometer and		1]	
	Piezometer Casings	Each	\$135.00	0.00	\$0.00
	e. Special Field Services	Per Hour	\$110.00	0.00	\$0.00
(38)	Resident Field Geotechnical Engineer				
/	(See Section II - D of this Appendix)	Per Hour	\$74.00	32.00	\$2,368.00
(39)	Railroad Expenses	Cost + 10%	\$0.00	0.00	\$0.00
40)	Twenty Four Hour Water Levels	- ·			
,	a. Field Measurements	Each	\$25.00	42.00	\$1,050.00
	b. PVC Slotted Pipe	Meter	\$13.00	0.00	\$0.00
(41)	Special Backfilling of Boreholes		******		
•••	a. 3 to 9 Meters	Each	\$81.00	19.00	\$1,539.00
	b. More than 9 Meters	Meter	\$15.00	0.00	\$0.00
	c. Pavement Restoration	- Each	\$30.00	20020	\$0.00 GOO.
(42)	Heavy Equipment Rental	Cost + 10%	\$1.10	467.50	\$514.25
(43)	Skid Rig Moving Time in Excess of 1/2 Hour	Per Hour	\$108.00	0.00	\$0.00
(44)	Traffic Control		1 00.00		
777	a. Worksite Setup 1 or 6	per day	\$115.00	0.00	\$0.00
	1 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	\$490.00	7.00	\$3,430.00
		per day	\$400.00	0.00	\$0.00
	c. Worksite Setup 9d. Worksite Setup 11	per day	\$430.00	0.00	\$0.00
(45)	Controlling Committee	Cost + 10%	\$0.00	0.00	\$0.00
(43)	Centerline Surveying	-	Ψ0.00		\$0.00
	SUBTOTALS		<u> </u>		\$21,818.55
	SUBTUTALS				+ 6+7.17
					22418.55
ITEM	ITEM DESCRIPTION	UNIT	UNIT	FINAL	FINAL
NO.	TEMPOLOGICATION		PRICE	QUANTITY'	COST
MV-			100000000000000000000000000000000000000	284848844800000	
	B. GEO. LABORATORY TESTING				
(46)	Field Permittivity Test			1	
70)	a. 1-5 Tests Per Authorization	Each	\$300.00	0.00	\$0.00
	b. More than 5 Tests Per Authorization	Each	\$230.00	0.00	\$0.00 \$0.00
(47)		Each	\$5.20	46.00	\$239.20
(47) (49)	Moisture Content Test	_ Each Each	\$23.00	4.00	\$239.20 \$92.00
(48) (40)	Liquid Limit Plantia Limit and Plantinity Index	Each	\$23.00	5.00	\$80.00
(49)	Plastic Limit and Plasticity Index	 1	\$10.00	5.00	\$160.00
(50)	Sieve Analysis	_ Each	\$32.00		
(51)	Hydrometer Analysis	Each		4.00	\$140.00
(52)	a. Unconfined Compression Test	_ Each	\$30.00	4.00	\$120.00

	b. Remolding of three (3) Soil Samples with lime/cement		670.00	0.00	80.00
	(3 samples = one unit)	_ Each	\$78.00	0.00	\$0.00
(53)	Specific Gravity Test	Each	\$26.00 \$13.10	0.00	\$0.00
(54)	Unit Weight Determination	Each	\$13.70	0.00	\$0.00 \$0.00
(55)	Consolidation Test	_ Each	\$345.00	0.00	\$0.00
(56)	Triaxial Test				
	a. Unconsolidated-Undrained (UU)	Each .	\$260.00	0.00	\$0.00
	b. Consolidated-Undrained (CU)	Each	\$400.00	0.00	\$0.00
	c. Consolidated-Drained (CD)	Each	\$565.00	0.00	\$0.00
	d. Pore Pressure Measurement with a. or b.				
	and Use of Back Pressure for Saturation	Each	\$175.00	0.00	\$0.00
(57)	Soil Support Testing	Each	\$0.00	0.00	\$0.00
	a. California Bearing Ratio Test	Each	\$395.00	1.00	\$395.00
	b. Subgrade Resilient Modulus	Each	\$800.00	0.00	\$0.00
(58)	Standard Moisture-Density Relationship Test	Each	\$102.00	1.00	\$102.00
(59)	Loss on Ignition Test	_ Each	\$15.00	0.00	\$0.00
(60)	pH Test	Each	\$10.00	5.00	\$50.00
	SUBTOTALS				\$1,378.20
ITEM.	ITEM DESCRIPTION	UNIT	UNIT	FIXAL	FINAL
NO.			PRICE	DUANTITY	COST
	C. GEOTECHNICAL ENGINEERING				
(61)	Geotechnical Profile and Related Work				
	a. Without Soil Subgrade Drawings	_ per kilometer	\$575.00	0.00	\$0.00
ı					
1	b. With Soil Subgrade Drawings	_ per kilometer	\$700.00	0.00	\$0.00
	b. With Soil Subgrade Drawings c. Soil Subgrade Drawings (only)	_ per kilometer _ per kilometer	\$700.00 \$150.00	0.00 0.00	\$0.00 \$0.00
(62)	c. Soil Subgrade Drawings (only) Geotechnical Report	— r	\$150.00		\$0.00
(62)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation	per kilometer per kilometer	\$150.00 \$650.00	0.00 5.00	\$0.00 \$3,250.00
(62)	c. Soil Subgrade Drawings (only) Geotechnical Report	per kilometer	\$150.00 \$650.00 \$925.00	0.00	\$0.00 \$3,250.00 \$0.00
(62)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation	per kilometer per kilometer	\$150.00 \$650.00	0.00 5.00	\$0.00 \$3,250.00
(62) (63)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation	per kilometer per kilometer per kilometer	\$150.00 \$650.00 \$925.00 \$275.00	0.00 5.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00
	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment	per kilometer per kilometer per kilometer per kilometer Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00	0.00 5.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$600.00
	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment	per kilometer per kilometer per kilometer per kilometer Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00	0.00 5.00 0.00 0.00 1.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$600.00 \$0.00
	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design	per kilometer per kilometer per kilometer per kilometer Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00	0.00 5.00 0.00 0.00 1.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$600.00
(63)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis	per kilometer per kilometer per kilometer per kilometer Each Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1,100.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$600.00 \$0.00 \$0.00
(63) (64)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis	per kilometer per kilometer per kilometer per kilometer Each Each Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1,100.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$600.00 \$0.00 \$0.00
(63) (64)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$450.00 \$650.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$600.00 \$0.00 \$0.00 \$0.00
(63) (64)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method	per kilometer per kilometer per kilometer per kilometer Each Each Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1,100.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$600.00 \$0.00 \$0.00
(63) (64)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1,100.00 \$450.00 \$850.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$600.00 \$0.00 \$0.00 \$0.00 \$0.00
(63) (64) (65)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each Eac	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1,100.00 \$650.00 \$850.00 \$500.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00
(63) (64) (65)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures C/O or C and O Analysis b. Corrective Measures	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each Each Each Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1,100.00 \$450.00 \$850.00 \$500.00 \$700.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00
(63) (64) (65)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis c. Corrective Measures c. Stage Construction Corrective Method	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each Eac	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1,100.00 \$650.00 \$850.00 \$500.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00
(63) (64) (65)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis c. Corrective Measures c. Stage Construction Corrective Method Bridge Foundation Analysis and Recommendations	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each Each Each Each Each Each Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1.100.00 \$450.00 \$850.00 \$500.00 \$700.00 \$850.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00
(63) (64) (65)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Bridge Foundation Analysis and Recommendations a. Shallow Foundation	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each Each Each Each Each Each Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1.100.00 \$450.00 \$850.00 \$500.00 \$700.00 \$850.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00 1.00 0.00 1.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00
(63) (64) (65)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Bridge Foundation Analysis and Recommendations a. Shallow Foundation b. Deep Foundation	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each Each Each Each Each Each Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1.100.00 \$450.00 \$850.00 \$500.00 \$700.00 \$850.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00
(63) (64) (65)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Bridge Foundation Analysis and Recommendations a. Shallow Foundation b. Deep Foundation c. Settlement Analysis for Bridge Pier Foundations	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each Each Each Each Each Each Each Each Each Each Each Each Each	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1.100.00 \$450.00 \$850.00 \$500.00 \$700.00 \$850.00 \$365.00 \$635.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00
(63) (64) (65)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Bridge Foundation Analysis and Recommendations a. Shallow Foundation b. Deep Foundation c. Settlement Analysis for Bridge Pier Foundations 1. Bridge Pier	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each Eac	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1.100.00 \$450.00 \$650.00 \$500.00 \$700.00 \$850.00 \$365.00 \$350.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00
(63) (64) (65)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Bridge Foundation Analysis and Recommendations a. Shallow Foundation b. Deep Foundation c. Settlement Analysis for Bridge Pier Foundations 1. Bridge Pier 2. Embankment Plus Pier	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each Eac	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1.100.00 \$450.00 \$850.00 \$500.00 \$700.00 \$365.00 \$365.00 \$350.00 \$650.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00
(63) (64) (65)	c. Soil Subgrade Drawings (only) Geotechnical Report a. Without Soil Subgrade Investigation b. With Soil Subgrade Investigation c. Soil Subgrade Investigation (only) Settlement Analysis and Recommendations for Embankment a. Proposed Embankment b. Proposed and Existing Embankment Sand Wick Drain System Design Sliding Block Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Rotational Slope Stability Analysis a. C/O or C and O Analysis b. Corrective Measures c. Stage Construction Corrective Method Bridge Foundation Analysis and Recommendations a. Shallow Foundation b. Deep Foundation c. Settlement Analysis for Bridge Pier Foundations 1. Bridge Pier	per kilometer per kilometer per kilometer per kilometer Each Each Each Each Each Each Each Eac	\$150.00 \$650.00 \$925.00 \$275.00 \$600.00 \$650.00 \$1.100.00 \$450.00 \$650.00 \$500.00 \$700.00 \$850.00 \$365.00 \$350.00	0.00 5.00 0.00 0.00 1.00 0.00 0.00 0.00 1.00 0.00 1.00 0.00 1.00 0.00	\$0.00 \$3,250.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00 \$0.00

SUBTOTALS		<u> </u>		\$0.00
Pavement Analysis and Report	Each	\$580.00	0.00	\$0.00
	Each	\$34.00	0.00	\$0.00
		\$25.50	0.00	\$0.00
4. 17 : 1. 6. 1. 1. 4.	L			\$0.00
	-	1		\$0.00
	-1			\$0.00
	· 			\$0.00
	-	1		\$0.00
	1)	4	\$0.00
,	1	L	1	\$0.00
· ————————————————————————————————————		1	1	\$0.00
	-L	1		\$0.00
• • • • • • • • • • • • • • • • • • • •		\$134.00	0.00	\$0.00
<u> </u>	Each	\$97.00	0.00	\$0.00
		1 '	0.00	\$0.00
D. PAVEMENT INVESTIGATION Mobilization of Coring Fauinment	Each	\$75.00	0.00	\$0.00
ITEM DESCRIPTION	UNIT	UNIT PRICE	FINAL 26ANTITY	FINAL COST
SUBTOTALS				\$4,715.00
· · ·	Each	\$800.00	0.00	\$0.00
		\$0.00	0.00	\$0.00
Static Load Test	Each	i i	0.00	\$0.00
	Each	I	0.00	\$0.00
	1	1	0.00	\$0.00
· · · · · · · · · · · · · · · · · · ·	Per houe	I	0.00	\$0.00
Field Inspector	Per houe	\$48.00	0.00	\$0.00
STRUCTION INSPECTION AND MONITORING			1	1
Deep Dynamic Compaction Analysis	Each	\$900.00	0.00	\$0.00
Seepage Analysis	Each	\$650.00	0.00	\$0.00
d. Soil Nailing Wall Analysis	Each	1	0.00	\$0.00
	Each	\$1,100.00	0.00	\$0.00
c. Drilled-in-Pier Retaining Structure Analysis 1. Free Standing Structure	Each	\$700.00	0.00	\$0.00
2. Retaining Structure with Tie-Back System	Each	\$1,075.00	0.00	\$ 0.00
	Each	\$600.00	0.00	\$0.00
	Each	\$450.00	0.00	\$0.00
	Each	\$750.00	0.00	\$0.00
1. Shallow Foundation	Each	\$650.00	0.00	\$0.00
	2. Retaining Structure with Tie-Back System c. Drilled-in-Pier Retaining Structure 2. Retaining Structure with Tie-Back System 4. Soil Nailing Wall Analysis Seepage Analysis Deep Dynamic Compaction Analysis TRUCTION INSPECTION AND MONITORING Field Inspector Monitoring Geotechnical Instrumentation Integrity Testing Dynamic Pile Analysis Static Load Test Dynamic Pile load test Final Construction Inspection Report SUBTOTALS ITEM DESCRIPTION Mobilization of Coring Equipment Mobilization Mileage for Coring Equipment Pavement Core (Partial Depth) Subbase Sample Cement Concrete Pavement Core Density Determination Cement Concrete Core Compressive Strength Test Bituminous Extraction Test Sieve Analysis of Extracted Aggregate Test Recovery of Asphalt from Solution by Abson Method Theoretical Maximum Specific Gravity Test Bulk Specific Gravity Test Air Voids Calculation Core Report for Full Depth Core Core Report for Full Depth Core	Walls or Binwalls 1. Shallow Foundation 2. Deep Foundation 3. Settlement Analysis for Retaining Wall Foundations 4. Free Standing Structure Analysis and Recommendations 1. Free Standing Structure With Tie-Back System 2. Retaining Structure with Tie-Back System Each 2. Retaining Structure with Tie-Back System Each Each 3. Soil Walling Wall Analysis 1. Free Standing Structure With Tie-Back System Each Each Each Each Each Each Each Seepage Analysis Each E	Walls or Binwalls 1. Shallow Foundation 2. Deep Foundation 3. Settlement Analysis for Retaining Wall Foundations 4. Free Standing Structure Analysis and Recommendations 1. Free Standing Structure with Tie-Back System 2. Retaining Structure with Tie-Back System 3. Free Standing Structure with Tie-Back System 4. Free Standing Structure with Tie-Back System 4. Free Standing Structure 4. Per Standing Structure 5. Political Instructure with Tie-Back System 6. Drilled-in-Pier Retaining Structure Analysis 6. Drilled-in-Pier Retaining Structure Analysis 7. Free Standing Structure 7. Retaining Structure with Tie-Back System 8. Each 8. \$700.00 8. Seepage Analysis 8. Each 8. \$735.00 8. Each 8. \$735.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. Each 8. \$650.00 8. \$600.00 8. Each 8. \$650.00 8. \$600.00 8. Each 8. \$650.00 8. \$600.00 8. \$600.00 8. \$660.00 8.	Walls or Binwalls

FINAL COST OF GEOTECHNICAL FIELD INVESTIGATION (A)_

22418:55

FINAL COST OF GEOTECHNICAL LABORATORY TESTING (B)	\$1,378.20
FINAL COST OF GEOTECHNICAL ENGINEERING (C)	\$4,715.00
FINAL COST OF GEOTECHNICAL INVESTIGATION	\$27,911.75
FINAL COST OF PAVEMENT INVESTIGATION (D)	\$0.00
TOTAL FINAL COST OF GEOTECHNICAL AND PAVEMENT INVESTIGATION	\$27,911.75
	28511.75
PREPARED BY: A.T.	28511.75
PREPARED BY: A.T. CHECKED BY: S.S.H	28 211.75